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ANNUAL AIR QUALITY DATA SUMMARY FOR MONTANA

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I. INTRODUCTION

This report is the fourth annual air quality data summary published by the Montana Department of Health and Environmental Sciences (SDHES). The data presented consists of data collected throughout the calendar year of 1978 and from nearly all locations in Montana. The report is divided by area. Each area is further divided into an air quality section and a meteorological section. A map and other general information is included to describe what parameters were measured and their approximate location. All major air pollutants and meteorological parameters are summarized in each of these sections. Figures and tables are supplied when appropriate.

Appendix A summarizes the federal and Montana ambient air quality standards. Appendix A also contains a description of the Prevention of Significant Deterioriation (PSD) increments and area classifications.

Appendix B lists the staff and appropriate other personnel involved in various air quality studies.

The data collected within this report consists of data generated by the Air Quality Bureau of the Montana Department of Health and Environmental Sciences, the Cascade County Air Pollution Control, the Missoula City-County Health Department, the Yellowstone County Air Pollution Control, and various other private contributors.

II. BILLINGS AREA

A. This section of the report deals with the data collected principally in the city of Billings and some of the surrounding area. Data concerning total suspended particulate, sulfur dioxide, nitrogen dioxide, ozone, and respirable particulates, and various meteorological parameters are discussed. A great deal of the data is represented in the form of graphs and figures.

The elevation of the Billings area varies from about 3,100 feet to 3,600 feet. The area is borderlined between the Great Plains and the Rocky Mountains and therefore has a climate which has characteristics from both regions. The 1970 population for Billings was 61,581 with a projected 1985 population of 87,050. Laurel, located about 15 miles southwest of Billings, had a 1970 population of 4,454 witha 1985 projection of 8,200. Both towns have an expanding population.

There are several important industries to both areas. Three refineries, a coal-fired power plant, a sugar beet factor, and a sulfur plant are all important business activities to the area. These sources along with automotive and home heating devices are all possible contributors to air pollution levels observed in the area.

1. Total Suspended Particulate

Total suspended particulates have been measured in the Billings area for manyyears. Figure I.A.2 shows the 1978 monthly averages of total suspended particulate for 5 selected sites. The geometric average at City Hall, the highest recording station in the area, was 66 ug/m^3. This figure falls below

the State of Montana and federal primary standards for this parameter. This figure, however, is above the federal secondary standards of 60 ug/m^3.

The Lockwood site, located at the Lockwood School, was discontinued in July because of construction activities on the site. The site will probably be reopened in the spring of 1979 at a location within about 100 yards of the original site. The Central Park station is located in Central Park and was started as a result of the MAPS (Montana Air Pollution Study) project in June 1979.

The data tends to show that the higher TSP (Total Suspended Particulate) readings are observed in the spring and fall (and to some extent summer). The lowest months seem to be November, December and January. The lower readings in these months is probably influenced by the amount of snow cover.

2. Sulfur Dioxide

Sulfur dioxide was monitored at three locations throughout the 1978 year. A downtown site (27th and Montana) showed relatively low concentrations. The annual average was below .005 ppm with a one-hour maximum of .17 which occurred in January. See Figure II.A.3.

Another site located in the city of Billings (Central Park) has shown higher readings than the downtown site. The maximum one-hour level was 1.95 ppm with an annual average of about .009 ppm (there was less than a full year's data which does not allow the determination of a precise annual average). This site is generally in a residential section of Billings and probably represents a population exposure level.

A site was located about one mile from the Cenex refinery in Laurel. This site showed high levels of SO_2 compared to the surrounding area. The

annual average concentration of sulfur dioxide was .04 ppm with the highest one-hour concentration being .66 ppm. This sampler is influenced by the refinery. Higher values were noted, especially in the fall and winter months. Some high values were also recorded in early spring.

3. Ozone

Ozone was monitored in three locations during the 1978 year. The locations at 27th and Montana and Central Park, as described above, were used for monitoring ozone for part of the year. See Figure II.A.4.

The 27th and Montana site was operated through July, 1978. The maximum one-hour average was .12 which occurred in March. The Central Park Site, which was activated in July, 1978, had a peak one-hour average of .11 ppm. The data from these two sites show no violations of the Federal standards.

A three-month measurement of ozone was initiated just outside of Worden, Montana. An attempt was made to see if there were any elevated concentrations of ozone several miles from the city of Billings. The monitor was located about 22 miles northeast of the city. The highest monthly average was .02 ppm. The maximum one-hour average observed was .20 ppm.

4. Nitrogen Dioxide

Two nitrogen dioxide monitors were operating in the Billings area during 1978. They were located at the 27th and Montana and Central Park sites already described.

For the period between January and the middle of March, 1978, the average NO_2 reading was .038 ppm. The maximum one-hour value was .175 ppm. At Central Park the maximum one-hour reading was .05 ppm with a mean value for the period of .011 ppm.

5. Carbon Monoxide and Total Hydrocarbons

Carbon monoxide was measured at the 27th and Montana site for the first six months of 1978. The average for the six months was 1.8 ppm. The maximum one-hour concentration recorded was 15.9 ppm, which occurred in January. No violations of the federal 8-hour or 1-hour standards were noted.

Total hydrocarbons were measured at the 27th and Montana and the Central Park site for part of 1978. Hydrocarbon levels measured in Billings are higher than levels observed throughout the rest of the state. The average concentration for the first five months of 1978 was 3.9 ppm. The peak one-hour maximum was 11.4 ppm which occurred in February. The values for Central Park have been lower than those observed at 27th and Montana. Winter and fall months appear to contain the higher observed values.

There are no ambient standards for total hydrocarbons.

6. Particle Size

Measuring particulates by size distribution has just begun in the Billings area. It is being measured as part of the MAPS project at the Central Park site. A dichotomous (or virtual) sampler was installed in September, 1978. The sampler measures particles in three ranges: 1. less than 2.5 microns; 2. between 2.5 and 15 microns; and 3. less than 15 microns (i.e. sum of 1 and 2). The average concentration of fine particulate (less than 2.5 microns) was 21.3 ug/m^3, the average coarse particle concentration (between 2.5 and 15 microns) was 16.8 ug/m^3, while the average respirable particulate concentration (less than 15 microns) was 38.1 ug/m^3.

This particular device is of special interest since it is this size of particles that has the greatest potential impact upon lung tissue. The data is preliminary at this point and as such the meaning of these numbers are

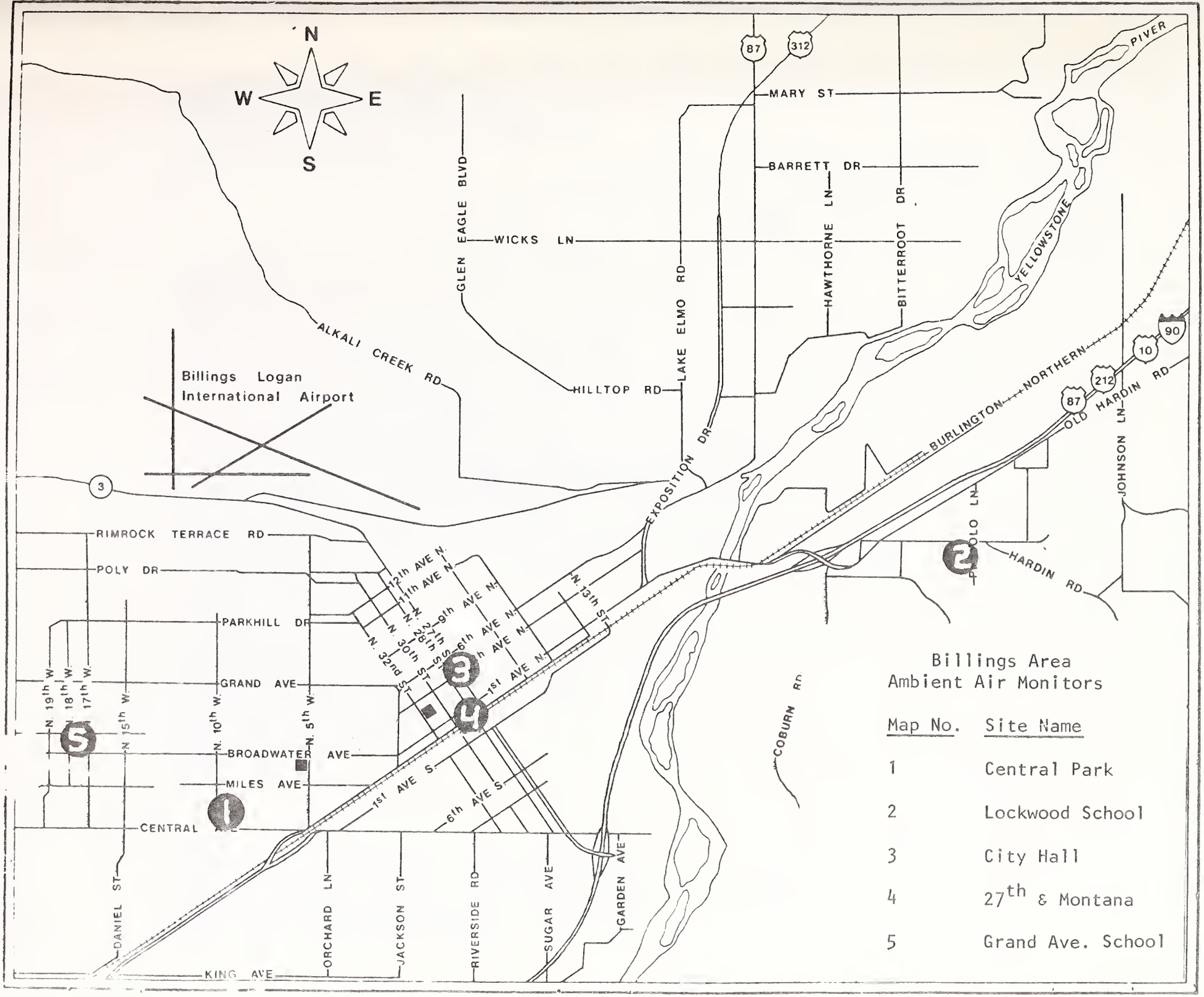
unclear. No national standards yet exist for this pollutant.

B. Billings Area Wind Summary

Tables II.B.1 and II.B.2 summarize the wind speed and direction for the Billings area for the latter half of 1978. The data listed is for the Central Park site in downtown Billings. The data was obtained from hourly averages of wind speed and direction. The instrument was located on a 30-foot tower mounted next to an air quality sampling trailer. The values in the tables are in percent of occurrence for the category listed. The wind speed categories are in meters per second (one meter per second = 2.2 miles per hour).

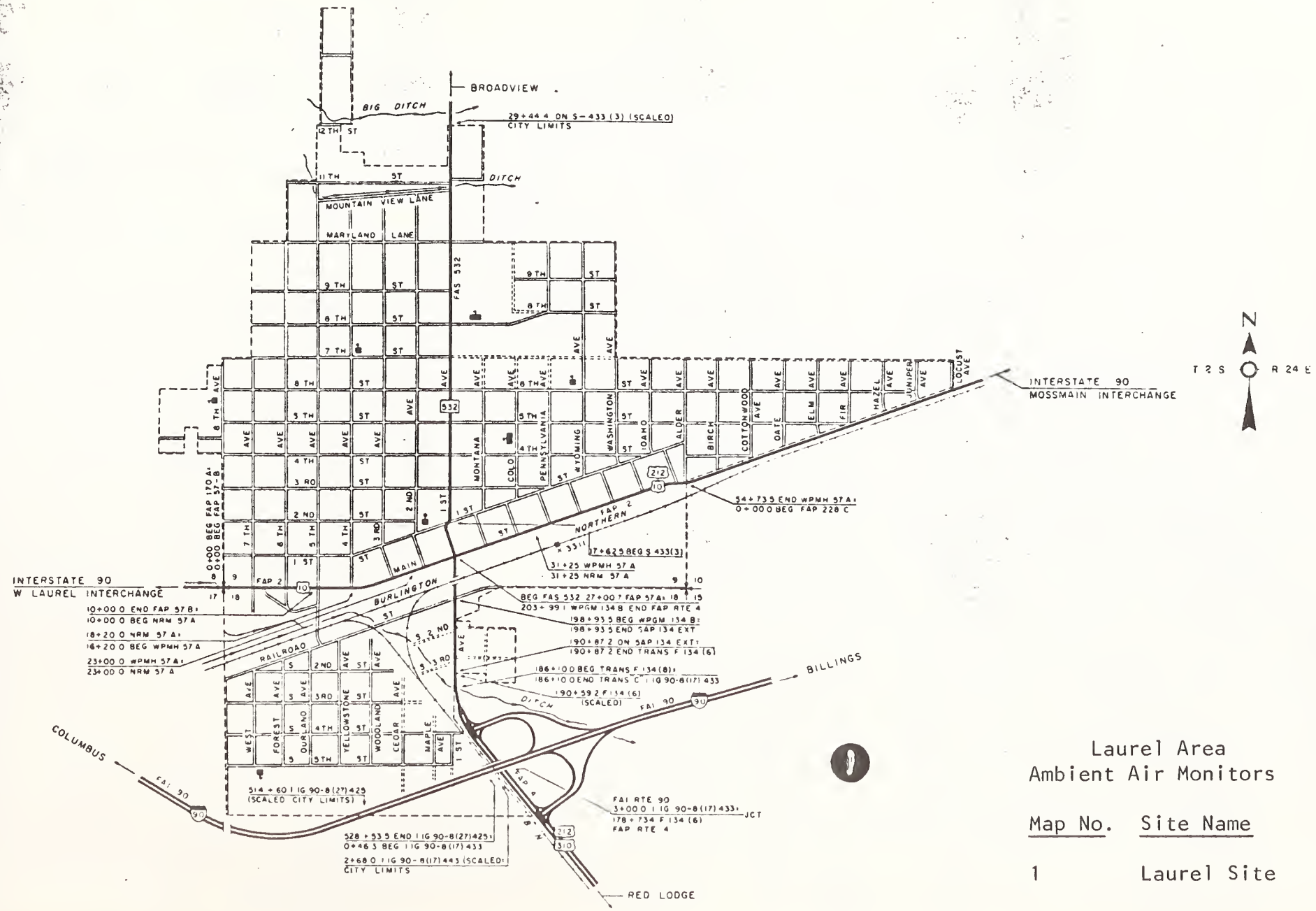
Since the wind instrument was not installed until July 1978, very little data is available for the year. Briefly reviewing the data, the wind speeds in the Billings area averaged 0.9 to 3.4 meters per second (m/sec) for the August through December period. The highest average wind speeds occurred in December while the lowest wind speeds occurred in August. During August over 85 percent of the winds were less than 1.6 m/sec (3.5 miles per hour). In December this figure had reduced to 22 percent of the winds less than 1.6 m/sec.

The wind direction data shows a predominance of west-southwest through west-northwest winds. The least frequent wind direction was from the east-southeast. During December, the month with the highest average wind speeds, the west wind had the highest frequency (54 percent).



Billings Area
Ambient Air Monitors

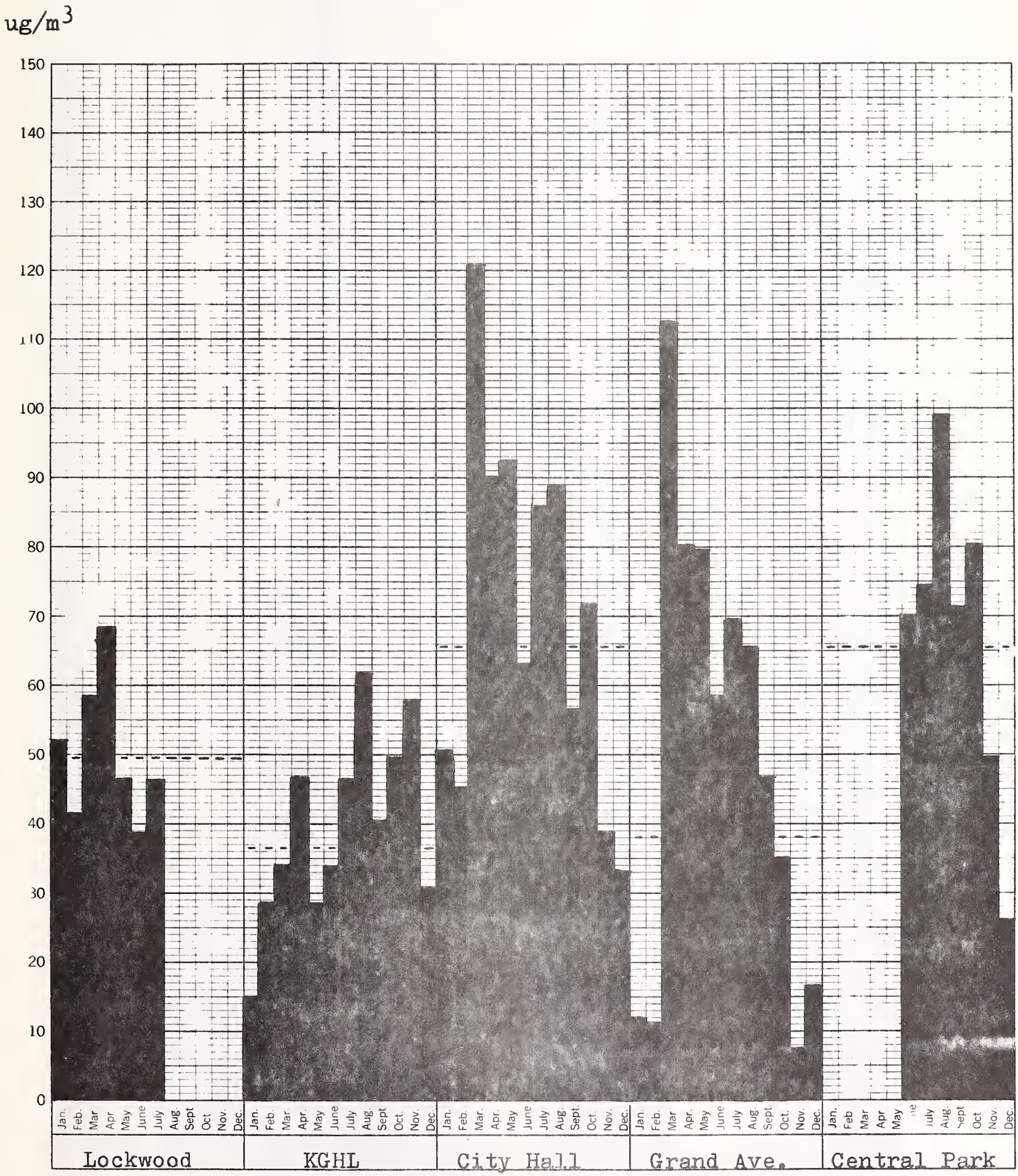
Map No.	Site Name
1	Central Park
2	Lockwood School
3	City Hall
4	27th & Montana
5	Grand Ave. School



Laurel Area
Ambient Air Monitors

Map No.	Site Name
1	Laurel Site

Figure II.A.2



Location: Billings Area

Parameter: Total Suspended Particulate

Units: Micrograms/cubic meter

.------: Annual Geometric Mean

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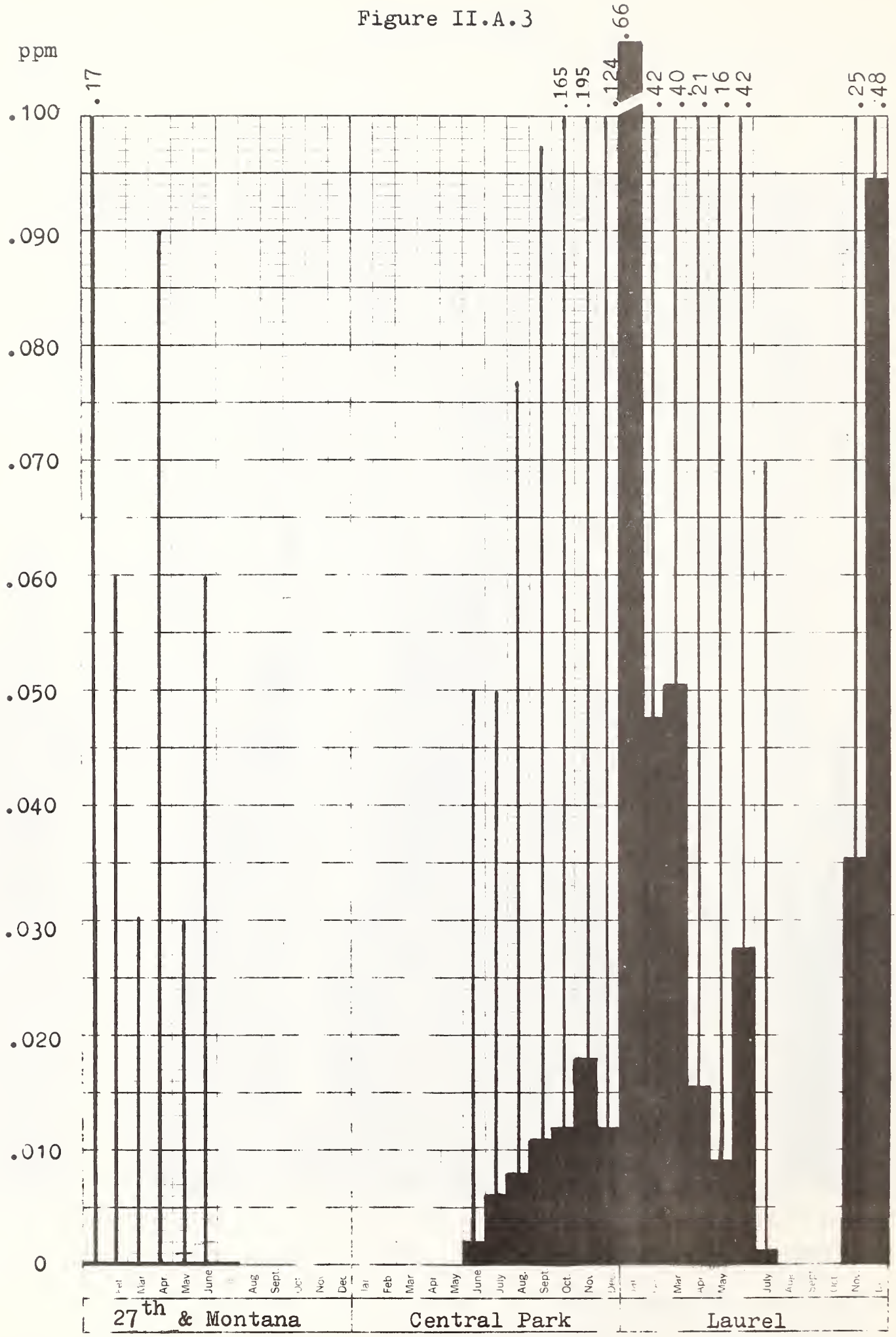
Figure II.A.3



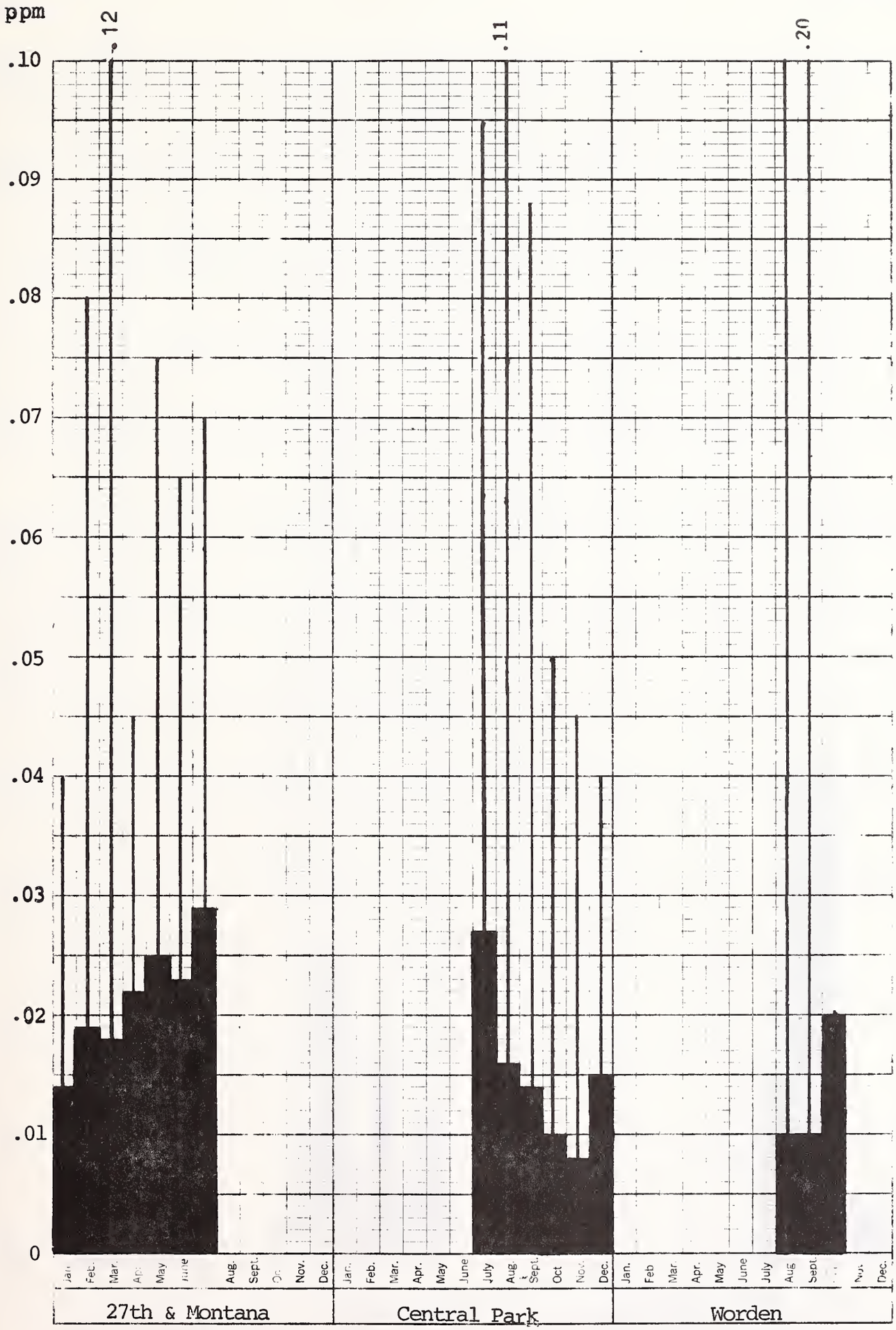
Location: Billings Area

Center Line: High Hour Reading

Parameter: Sulfur Dioxide

Units: Parts per million

Figure II.A.4



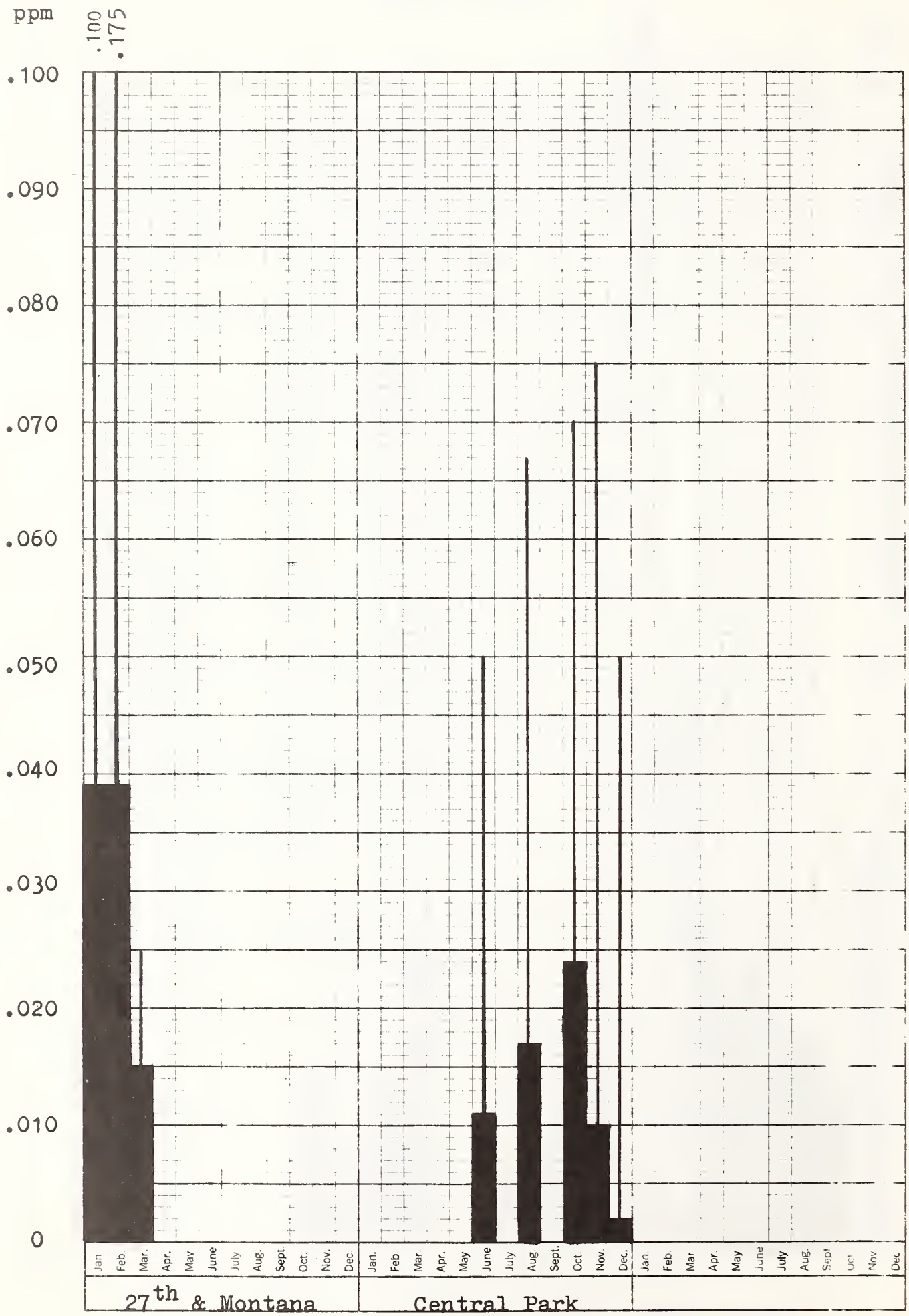
Location: Billings Area

Center Line: High Hour Reading

Parameter: Ozone

Units: Parts per million

Figure II.A.5



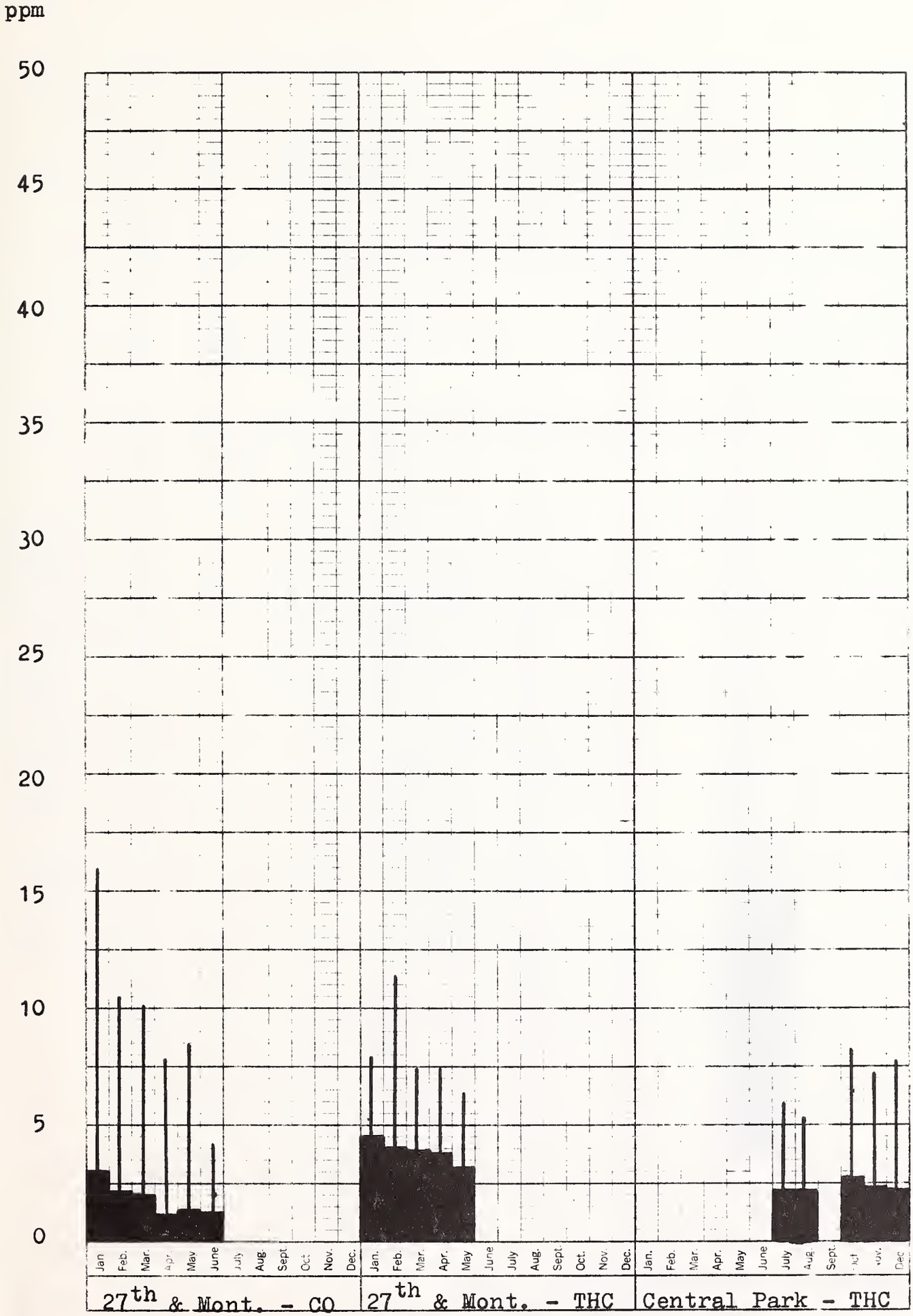
Location: Billings Area

Center Line: High Hour Reading

Parameter: Nitrogen Dioxide

Units: Parts per million

Figure II.A.6

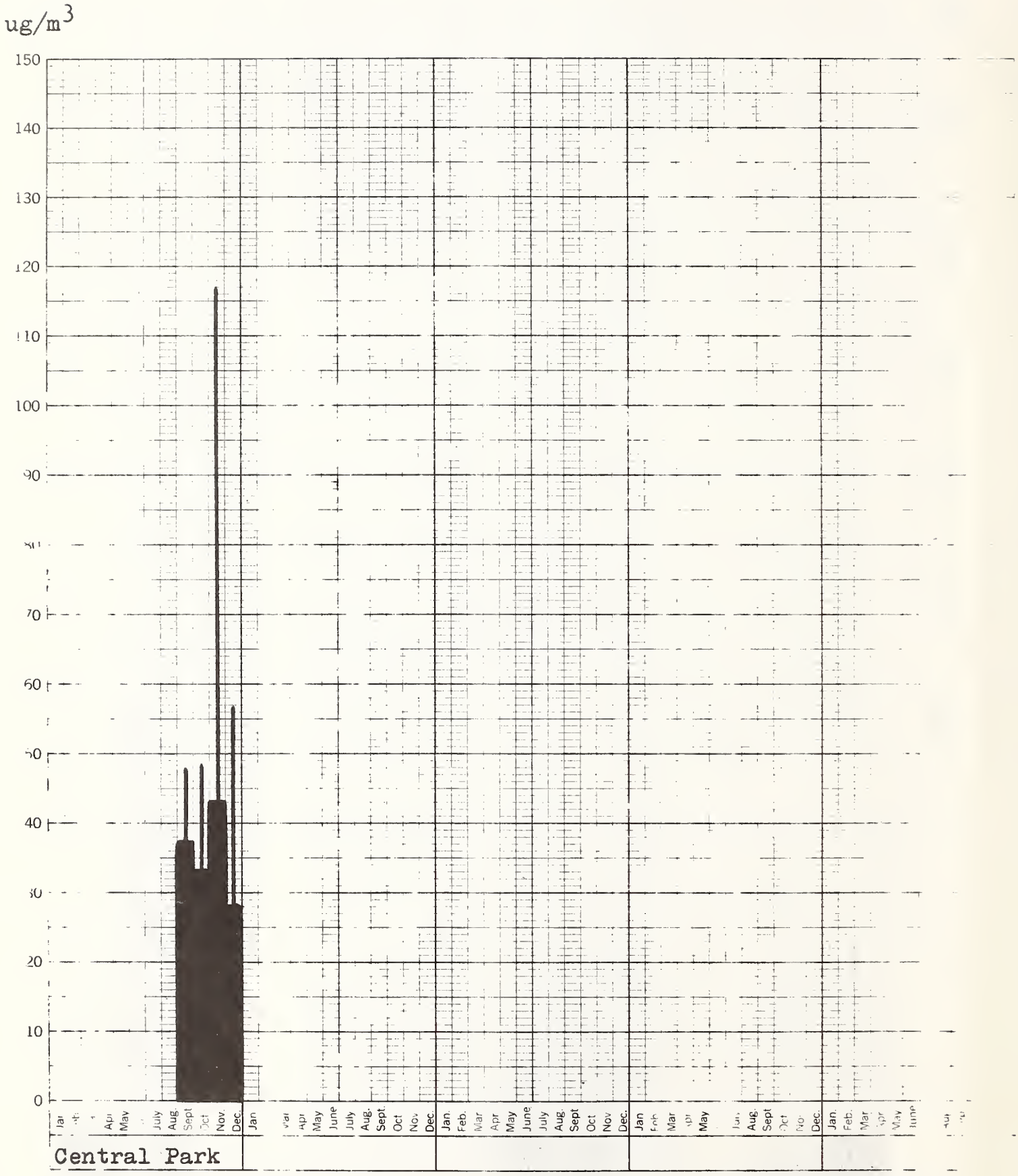


Location: Billings Area Center Line: High Hour Reading

Parameter: Carbon Monoxide & Total Hydrocarbons

Units: Parts per million

Figure II.A.7



Location: Billings Area

Center Line: High Hour Reading

Parameter: Respirable Particulate

Units: Micrograms per cubic meter

TABLE II.B.1

MONTHLY SUMMARY OF SURFACE WIND SPEED
Billings - Central Park Site - 1978
(Values in percent of occurrence)

Speed (m/sec)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0.1 - 1.5	-	-	-	-	-	-	-	85.7	62.8	51.8	35.8	22.3
1.6 - 3.0	-	-	-	-	-	-	-	10.1	17.7	24.4	33.5	18.3
3.1 - 5.0	-	-	-	-	-	-	-	2.5	14.2	18.9	23.4	38.3
5.1 - 8.0	-	-	-	-	-	-	-	1.6	5.3	4.8	6.0	20.6
8.1 - 10.0	-	-	-	-	-	-	-	0.2	0.0	0.0	0.8	0.5
10.1 - 14.0	-	-	-	-	-	-	-	0.0	0.0	0.0	0.6	0.0
14.1 - 18.0	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0
18.1 - 22.0	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0
Over 22.0	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0
Average Speed (m/sec)	-	-	-	-	-	-	-	0.9	1.6	2.0	2.6	3.4

TABLE II.B.2

MONTHLY SUMMARY OF SURFACE WIND DIRECTION
Billings - Central Park Site - 1978
(Values in percent of occurrence)

Direction	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
N	-	-	-	-	-	-	-	8.5	5.9	7.0	2.5	1.8
NNE	-	-	-	-	-	-	-	2.7	1.9	3.3	7.4	1.8
NE	-	-	-	-	-	-	-	7.4	4.2	4.2	7.2	2.3
ENE	-	-	-	-	-	-	-	8.7	3.3	3.8	4.1	2.3
E	-	-	-	-	-	-	-	9.6	6.1	5.5	4.1	2.0
ESE	-	-	-	-	-	-	-	1.8	0.8	1.7	0.0	1.2
SE	-	-	-	-	-	-	-	1.6	1.9	3.3	1.4	1.2
SSE	-	-	-	-	-	-	-	1.3	1.7	1.7	1.0	0.8
S	-	-	-	-	-	-	-	2.7	3.3	1.8	1.4	0.2
SSW	-	-	-	-	-	-	-	3.6	1.9	2.8	1.4	1.5
SW	-	-	-	-	-	-	-	3.1	2.0	2.7	1.9	0.8
WSW	-	-	-	-	-	-	-	12.1	9.1	9.3	11.4	8.5
W	-	-	-	-	-	-	-	21.9	36.1	34.2	42.2	54.1
WNW	-	-	-	-	-	-	-	7.8	11.7	11.0	8.5	16.0
NW	-	-	-	-	-	-	-	4.0	5.5	2.5	3.1	3.0
NNW	-	-	-	-	-	-	-	3.1	4.7	5.3	2.7	2.5

III. BUTTE AREA

A. Section III of this report deals with ambient air quality data collected in the city of Butte and the surrounding area. Data discussed in this section includes total suspended particulate, sulfur dioxide, ozone, carbon monoxide, total hydrocarbons, respirable particulate, and various meteorological parameters. Most of the data is in the form of graphs and figures.

Populated areas of Butte and vicinity range in elevation from approximately 5,200 feet near the Stauffer Chemical Plant to approximately 6,000 feet at Walkerville. The city of Butte is located about four miles west of the Continental Divide. The area experiences a climate characteristic of its high elevation. Extreme cold spells, long snow cover and a short growing season are normal for the area. Frequent temperature inversions, especially in the winter months, tend to trap and hold pollutants. The population of Butte, which is declining, was 23,368 in 1970 and is expected to be about 22,850 in 1985.

Major potential sources of air pollution in the area include a large open pit copper mine, an ore concentrator, an elemental phosphorous plant, a tepee burner and several hot mix plants. Automobiles and home heating devices must also be considered as possible air pollution sources.

1. Total Suspended Particulate

Figure III.A.1 shows the monthly averages and the annual geometric mean of total suspended particulate for five selected sites in the Butte area. The highest annual geometric mean, 68.6 ug/m^3, was recorded at the Greely School

site near the Berkely Pit and Clyde E. Weed Concentrator. This figure is below the national primary annual geometric mean standard of 75 ug/m^3 but is above the national secondary standard of 60 ug/m^3. All other recording sites were below the 60 ug/m^3 level.

The next highest annual geometric mean, 56.7 ug/m^3, was recorded at the Hebgen Park site, approximately 3/4 of a mile from the Berkely Pit. The sampler on the roof of Dr. Canty's office, near St. James Community Hospital on the west side of town, recorded an annual geometric mean of 47.6 ug/m^3.

A new site was erected at the Floral Park Fire Station in the east section of town. The Floral Park site began operation in November of 1978. The site recorded a monthly average of about 49 ug/m^3 for November and about 43 ug/m^3 for December of 1978. The Richer site, near the municipal airfield, was the lowest reporting site with an annual geometric mean of 19.1 ug/m^3.

2. Sulfur Dioxide

Sulfur dioxide was monitored at Hebgen Park during the month of August, 1978. The monthly average for sulfur dioxide was .007 ppm with a one-hour maximum reading of .082 ppm. The state of Montana ambient air quality standard is .25 ppm for a one-hour maximum. Sulfur dioxide levels in Butte for the month of August were well below the state standard.

3. Ozone

Ozone was monitored at Hebgen Park from April through December of 1978. The highest monthly average was .038 ppm for the month of May. The highest one-hour reading was .077 ppm in August. There were no violations of the national one-hour standard of .12 ppm. The state of Montana has no ozone standard at this time. The highest ozone concentrations appear to have been in the late spring and summer with a definite decline in the fall and winter.

4. Nitrogen Dioxide

Nitrogen dioxide was monitored at Hebgen Park during the month of April, May, June, July, October and November of 1978. The highest monthly average, .035 ppm, was for November. The highest one-hour reading was .155, also in November. The nitrogen dioxide levels were well below the national annual average standard of .05 ppm. The state of Montana does not have a nitrogen dioxide standard at this time.

5. Carbon Monoxide

Carbon monoxide was monitored at two locations in Butte during 1978. The Alpine West site, approximately 1/4 mile from the Berkeley Pit, recorded high monthly average of 1.7 ppm for the month of January and a maximum one-hour reading of 15 ppm during October. The carbon monoxide data recorded at the Alpine West site indicates a pattern of higher ambient air levels during the late fall and winter months with the lowest levels occurring during the summer months. Although there was insufficient data collected at Hebgen Park to establish a yearly pattern, the carbon monoxide levels recorded during the months of July, August, October and November appear consistent with those at Alpine West for the same periods.

There were no violations of the national ambient air quality standards for carbon monoxide at either of the Butte recording sites. The state of Montana has no carbon monoxide standard at this time.

6. Total Hydrocarbons

Ambient air levels of total hydrocarbons were monitored at Hebgen Park in Butte during eight months of 1978. As can be seen in Figure III.A.3, the total hydrocarbon levels remained quite constant over the period monitored. There appears to be a slight increase in the spring and fall months over the

summer period. There is no data available for the winter period of December, January and February. There are no national or state standards for total hydrocarbons at this time.

7. Particle Size

Particle size distribution, using a dichotomous sampler, was monitored at four sites in Butte during the latter months of 1978. Particle size was measured in three ranges: 1. less than 2.5 microns; 2. between 2.5 and 15 microns; and 3. less than 15 microns (i.e. sum of 1 and 2).

The Butte MHD and MAPS sampler were both located at Hebgen Park. The average concentration of fine particulate (less than 2.5 microns) was 26.3 ug/m^3 for the months of November and December for the MAPS sampler. The average coarse particulate (between 2.5 and 15 microns) for the same period was 19.8 ug/m^3 while the average respirable particulate (less than 15 microns) was 46.1 ug/m^3. The MHD sampler, which operated from August through December of 1978, recorded an average fine particulate concentration of 19.4 ug/m^3, an average coarse particulate concentration of 28.4 ug/m^3 and an average respirable particulate concentration of 47.8 ug/m^3.

The Floral Park monitoring site was in operation through the months of November and December of 1978. During this period of time the sampler recorded an average fine particulate concentration of 12.5 ug/m^3, an average coarse particulate concentration of 9.2 ug/m^3 and an average respirable particulate concentration of 21.7 ug/m^3.

A special purpose sampler was operated for a few days during the month of October at the corner of Cobben and Utah in Butte. The sampler was set to run concurrent with urine sampling of children in a nearby school. The sampler recorded an average fine particulate concentration of 24.7 ug/m^3, an average

coarse particulate concentration of 16.7 ug/m^3 and an average respirable particulate concentration of 41.4 ug/m^3.

This particular device is of interest since it is this size of particles that has the greatest potential impact upon the lungs. The data is preliminary at this point and as such the meaning of these numbers is unclear. No national or state standards yet exist for this pollutant.

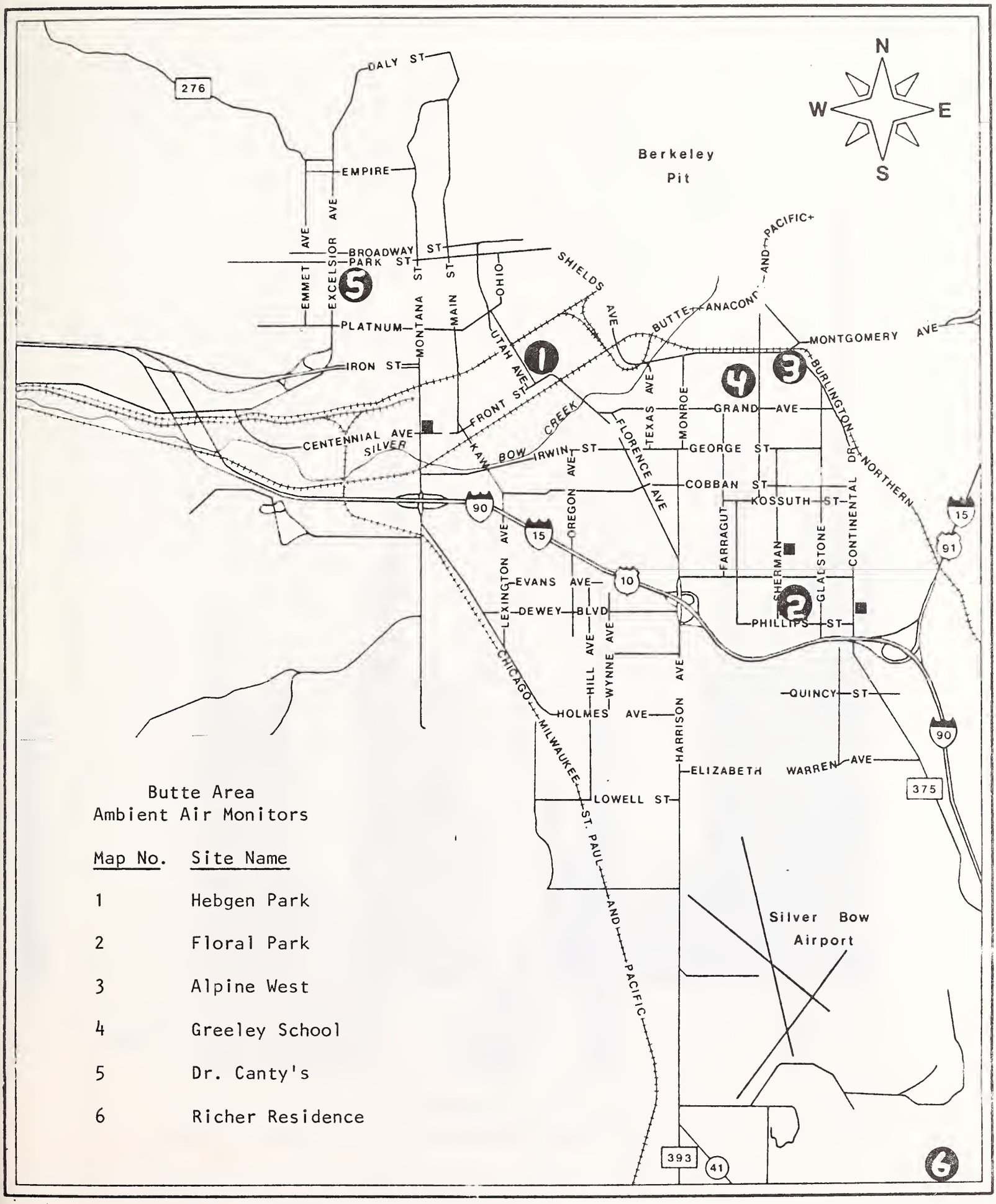
B. Butte Area Wind Summary

Tables III.B.1 and III.B.2 summarize the wind speed and direction for the Butte area for 1978. The data listed are primarily for the Hebgen Park site in the center of Butte. The wind system was moved to this site from the Alpine West site in June, 1978. The data was obtained from hourly averages of wind speed and direction. The instrument was located on a thirty foot tower next to an air quality sampling trailer. The values in the tables are in percent of occurrence for the category listed. The wind speed categories are in meters per second (one meter per second = 2.2 miles per hour).

Examining briefly the data for 1978, the wind speeds in Butte averaged monthly from 1.3 to 2.9 meters per second (m/sec). The late fall and winter seasons had the slowest wind speeds. During that period approximately 70 percent of the winds were less than 1.5 m/sec (3.3 miles per hour). The windiest month (month with the highest average wind speed) was April. Also April through June had the highest average wind speeds. The average for that period was about 2.7 m/sec (about six miles per hour). Also during the April through June period only 37 percent of the winds were less than 1.5 m/sec.

The wind direction data does not show any clear pattern or predominant wind. During all months the wind blew from every direction of the compass.

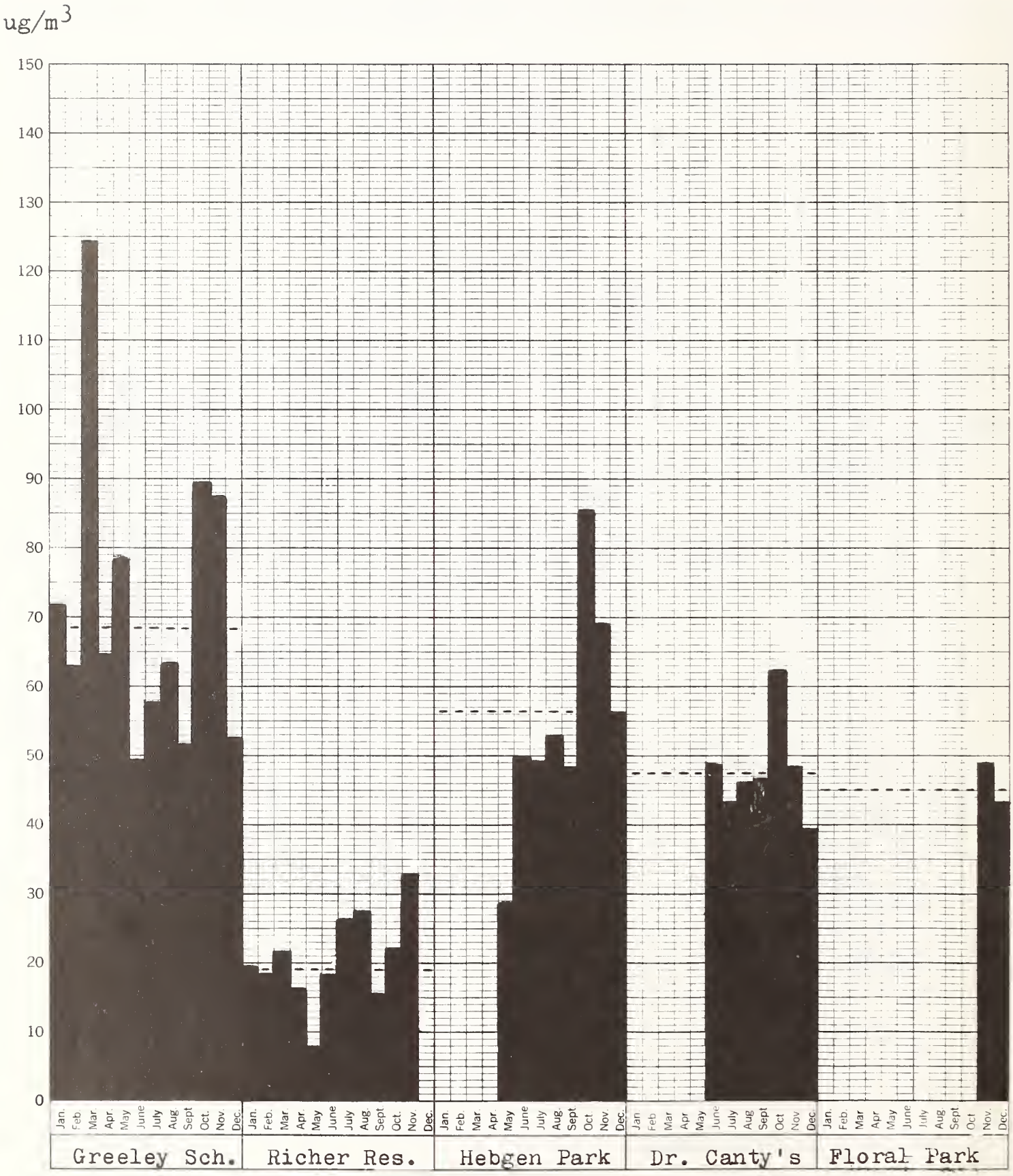
Looking at the windiest period (April through June) there was a greater percentage of west-northwest through north-northwest winds. During the fall months there is a stronger tendency toward a westerly wind. However by late winter this has switched to a southeast wind.



Butte Area
Ambient Air Monitors

Map No.	Site Name
1	Hebgen Park
2	Floral Park
3	Alpine West
4	Greeley School
5	Dr. Canty's
6	Richer Residence

Figure III.A.2



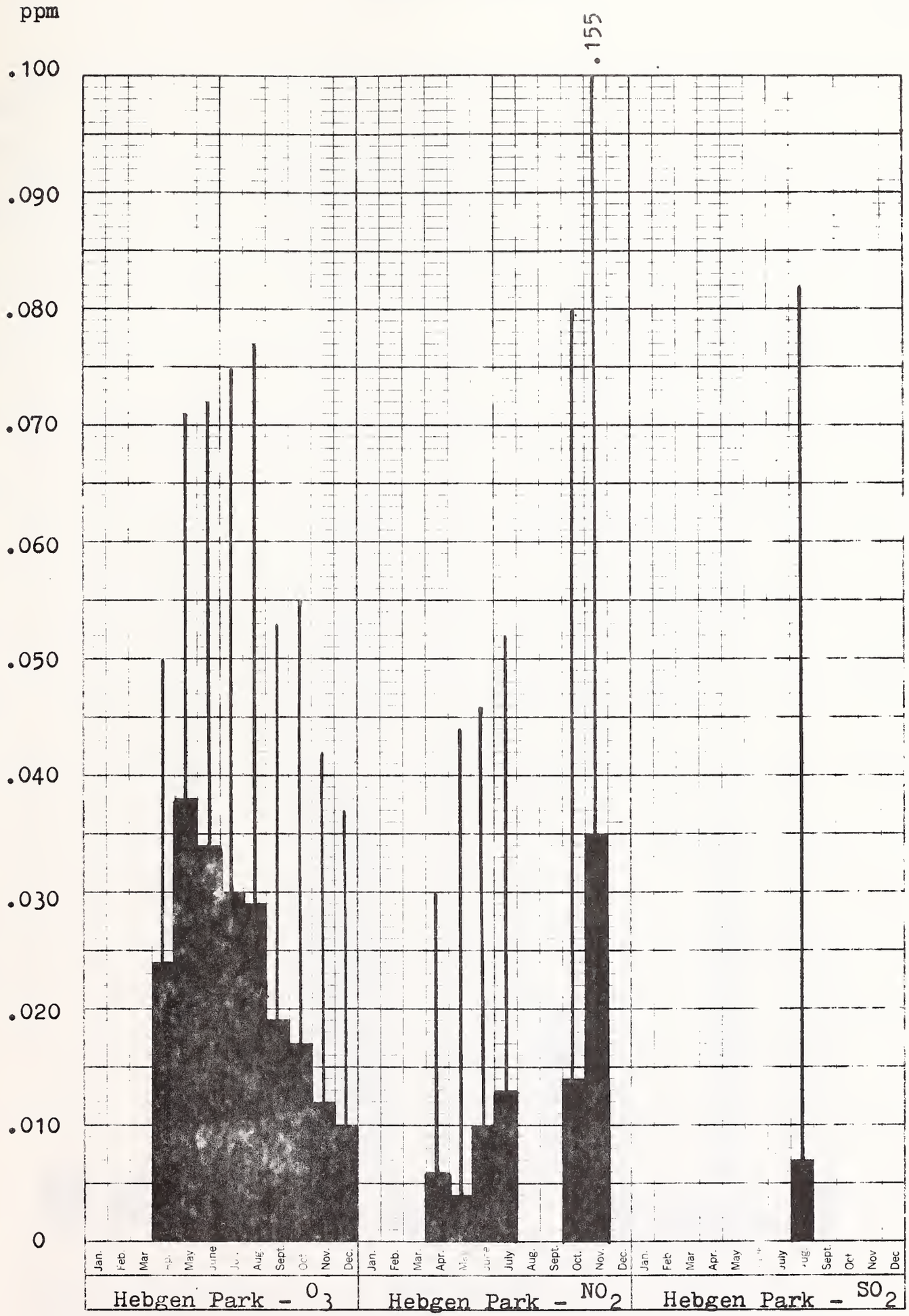
Location: Butte Area

Parameter: Total Suspended Particulate

Units: Micrograms /cubic meter

------: Annual Geometric Mean

Figure III.A.3

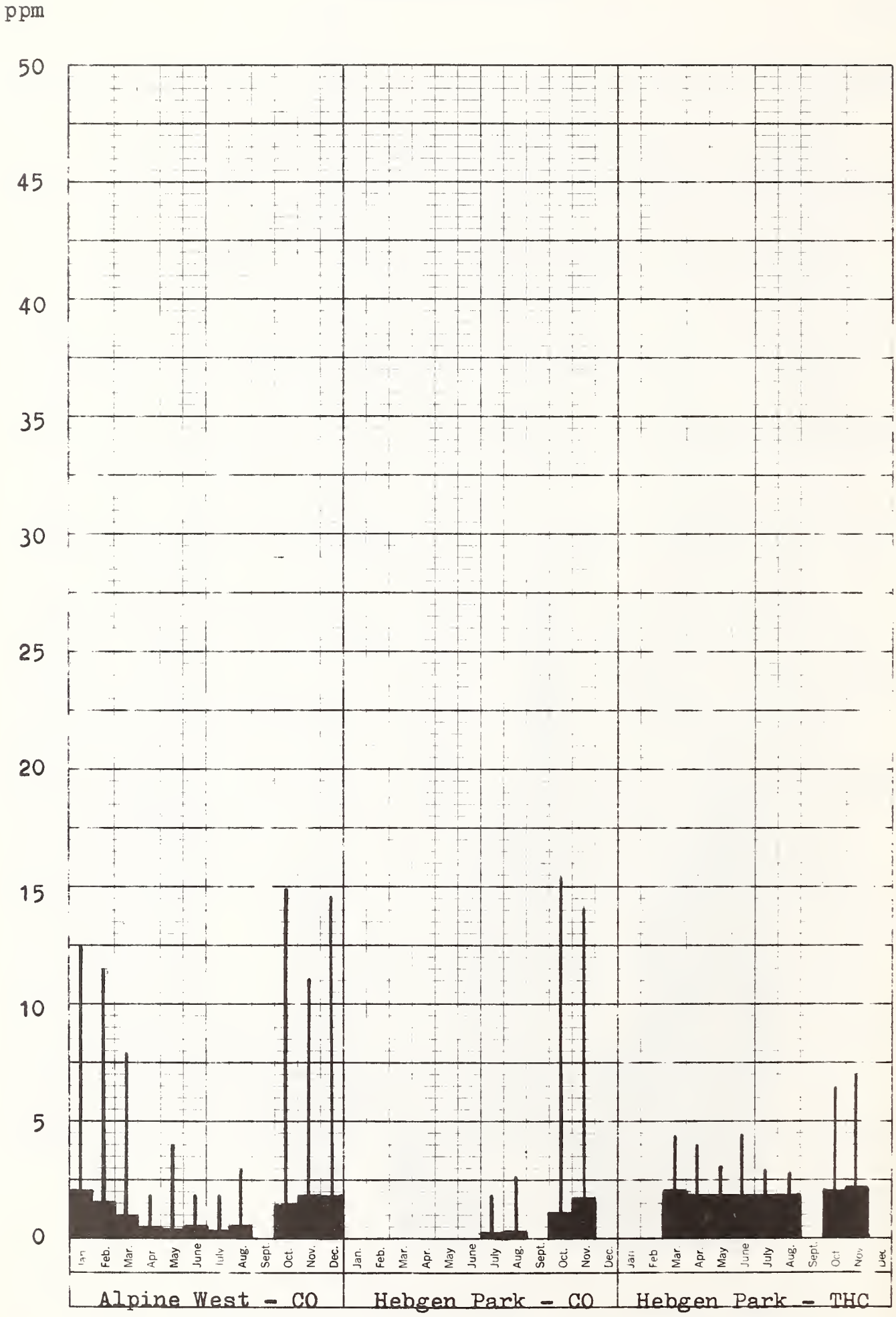


Location:- Butte Area Center Line: High Hour Reading

Parameter: Ozone, Nitrogen Dioxide & Sulfur Dioxide

Units: Parts per million

Figure III.A.4

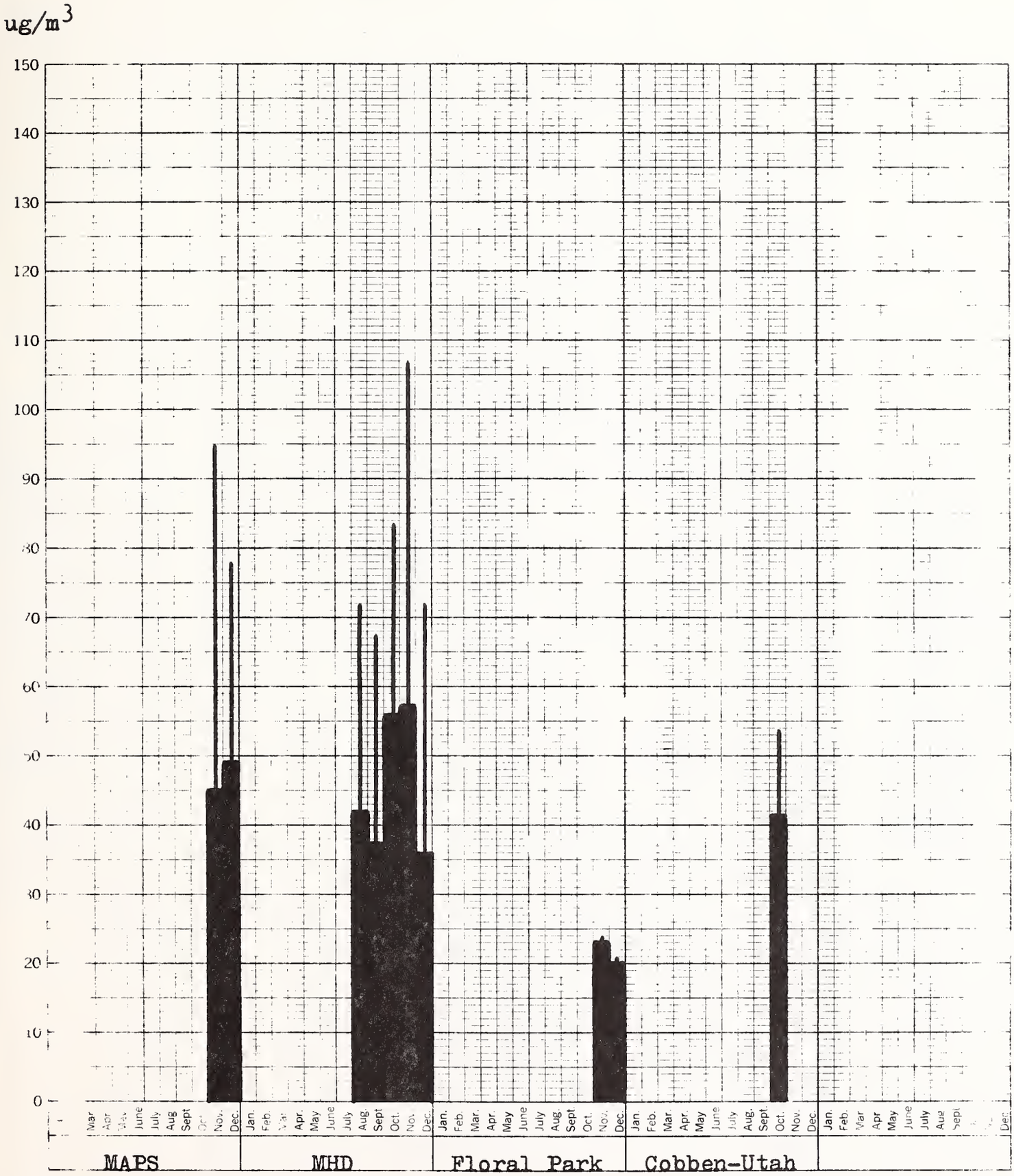


Location: Butte Area Center Line: High Hour Reading

Parameter: Carbon Monoxide & Total Hydrocarbons

Units: Parts per million

Figure III.A.5



Location: Butte Area

Center Line: High Hour Reading

Parameter: Respirable Particulate

Units: Micrograms/cubic meter

TABLE III.B.1

MONTHLY SUMMARY OF SURFACE WIND SPEED
Butte - Hebgen Park Site+- 1978
(Values in percent of occurrence)

Speed (m/sec)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0.1 - 1.5	73.6	68.9	66.9	34.8	32.5	44.9	59.3	59.1	58.1	66.2	74.8	69.2
1.6 - 3.0	15.5	20.3	19.3	26.9	26.8	22.9	24.0	23.3	21.1	17.4	12.6	15.6
3.1 - 5.0	10.3	10.4	11.8	25.2	28.2	22.1	14.3	16.6	17.8	13.0	9.6	12.8
5.1 - 8.0	0.6	0.4	2.0	12.4	11.7	10.0	2.5	1.1	2.9	3.4	3.0	2.4
8.1 - 10.0	0.0	0.0	0.0	0.9	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.1 - 14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14.1 - 18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18.1 - 22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Over 22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Speed (m/sec)	1.4	1.5	1.6	2.9	2.8	2.5	1.8	1.7	1.8	1.6	1.3	1.4

+ Instrument moved from Alpine West Site to Hebgen Park Site in June.

TABLE III.B.2

MONTHLY SUMMARY OF SURFACE WIND DIRECTION
Butte - Hebgen Park Site+- 1978
(Values in percent of occurrence)

Direction	Jan.	Feb.	Mar.*	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
N	5.4	2.1	3.5	2.4	2.8	1.5	6.7	6.2	4.5	3.8	2.6	4.9
NNE	4.8	6.2	6.7	3.6	12.3	5.4	5.1	8.6	4.2	6.3	7.4	4.9
NE	2.3	2.5	1.2	2.6	5.1	3.1	6.9	6.6	2.5	4.1	4.6	6.0
ENE	7.2	6.6	7.5	3.4	5.5	5.1	4.5	7.7	4.0	4.9	4.2	5.5
E	4.3	5.4	4.7	1.5	3.0	3.4	6.3	5.5	3.9	6.7	2.3	0.2
ESE	11.4	8.5	12.2	12.4	4.7	8.7	3.0	3.7	5.1	5.2	1.9	0.5
SE	7.0	7.0	9.4	6.0	3.4	3.1	4.5	4.9	6.2	4.5	2.6	1.5
SSE	14.5	13.3	12.6	7.7	5.7	12.8	3.4	3.8	7.4	5.3	3.9	3.7
S	6.2	6.8	7.9	4.5	3.8	6.6	4.0	3.3	5.7	6.3	3.7	4.7
SSW	9.1	7.7	7.1	6.6	6.2	7.5	5.4	7.8	6.8	8.8	10.6	5.5
SW	3.5	4.4	3.2	4.3	3.6	2.5	7.1	6.2	6.4	5.3	13.2	7.1
WSW	3.7	7.7	4.7	7.9	7.2	6.2	7.3	9.0	9.3	7.7	11.4	13.8
W	3.1	2.5	0.8	4.9	4.0	4.9	14.4	5.9	13.0	10.8	11.7	12.6
WNW	6.0	8.1	5.1	14.5	12.5	13.9	8.9	6.7	8.1	6.8	6.7	7.6
NW	6.4	4.8	5.9	9.4	9.3	5.6	6.4	5.5	5.9	5.5	5.6	11.8
NNW	5.0	6.4	7.5	8.5	10.8	9.7	6.0	7.7	7.0	7.9	7.7	9.7

+ Instrument moved from Alpine West Site to Hebgen Park Site in June.
* Less than full month of data.

IV. ANACONDA AREA

A. This section of the report deals with data collected in and about the area of Anaconda. Data concerning total suspended particulate, sulfur dioxide, nitrogen dioxide, and various meteorological parameters are discussed. The majority of the information is represented in the form of graphs and figures.

The elevation of Anaconda is approximately 5,200 feet. The town is located at the south end of the Deer Lodge Valley and northeast of the Anaconda-Pintlar wilderness area. The area experiences temperature inversions, which tend to trap and hold pollutants, approximately 40 percent of the time on an annual average. Population of the town is dropping rapidly from 9,771 in 1970 to an estimated 8,450 in 1985.

The Anaconda Company's copper smelter, on the east edge of town, is the major industrial complex in the area and is the source of approximately 80 percent of the sulfur dioxide emissions in the state. The smelter is also a source of particulates.

1. Total Suspended Particulates

Total suspended particulates were measured at three sites in the Anaconda area during 1978. The Lincoln School site at Cedar and Fifth is in the town of Anaconda and about two miles west of the smelter. The Lincoln School site recorded a geometrical mean of 35.5 ug/m^3 for the period of May through December of 1978. The highest monthly average for that period was 52 ug/m^3 in October.

The Highway Junction site is located near the junction of Lost Creek Highway and Highway 48 about two miles northeast of the smelter. This site was in operation the entire year of 1978 and recorded an annual geometric mean of 26.3 ug/m^3. The highest monthly average, 44 ug/m^3, was recorded in November.

The Philipsburg site is on the west edge of the town of Philipsburg about 500 yards from a lumber mill and tepee burner. Philipsburg is approximately 30 miles northwest of Anaconda. The annual geometric mean for the Philipsburg site was 42.6 ug/m^3. The highest monthly average was 80 ug/m^3 for the month of October. The Philipsburg site shows a pattern of higher total suspended particulate levels during the period of March through October with lower concentrations during the winter months.

None of the three sites were in violation of the national annual geometric mean standards for total suspended particulates.

2. Sulfur Dioxide

Five Air Quality Bureau sites in the Anaconda area monitored sulfur dioxide levels during some period of 1978. Violations of current national and state ambient air quality standards for sulfur dioxide emissions were seen at every location.

The locations of the Highway Junction and Lincoln School sites have been described above. The Mill Creek site is located approximately 1.6 miles east of the smelter. The Post Office site is on Main Street in the center of the town of Anaconda. The C-Hill site is approximately two miles west and 1/2 mile south of the smelter. This location is at an elevation of approximately 7,200 feet, about 900 feet higher than the smelter stack.

The highest sulfur dioxide concentrations were recorded at the Highway Junction, Mill Creek and C-Hill sites. The highest monthly average recorded in the area was .15 ppm at the C-Hill site for March of 1978. The highest one-hour maximum reading, 2.75 ppm, was recorded at Highway Junction during November of 1978. Other monthly averages and one-hour maximum levels can be obtianed from figures IV.A.2.

All five locations recorded violations of the state ambient air quality one-our standard of .25 ppm. The Highway Junction and Mill Creek sites showed an annual average above the national annual average standard of .03 ppm. The other three monitoring sites were not in operation enough months to establish a precise annual average.

3. Nitrogen Dioxide

Nitrogen dioxide was monitored in Anaconda, at the Lincoln School site, during the months of July, August, October, November and December of 1978. The highest monthly average was .013 ppm for December. The highest one-hour maximum was .050 ppm in November. There was insufficient data to determine an annual average. The national ambient air quality standard for nitrogen dioxide is .05 ppm annual average. The state of Montana does not have a nitrogen dioxide standard at this time.

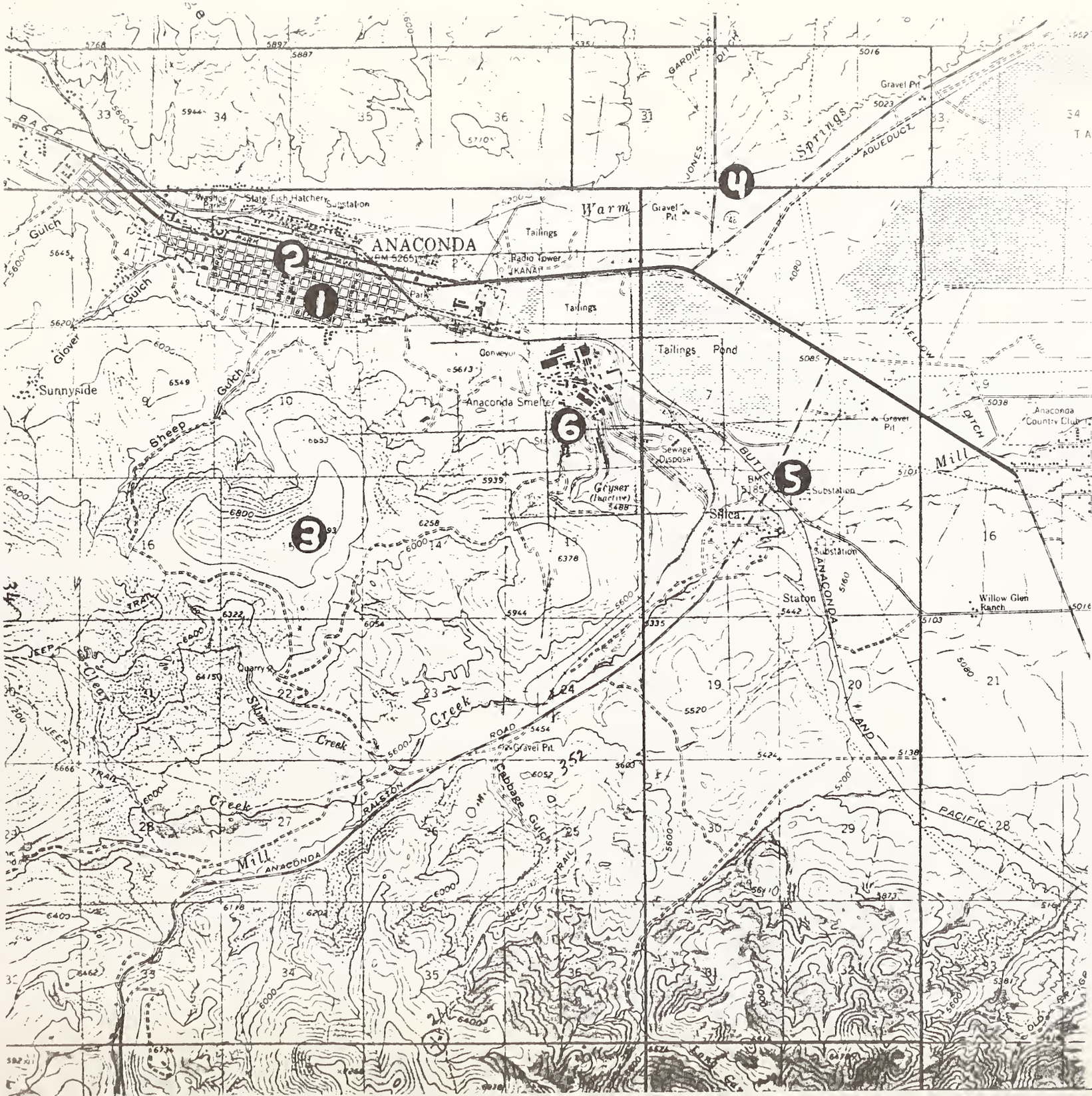
B. Anaconda Area Wind Summary

Tables IV.B.1 and IV.B.2 summarize the wind speed and direction for the Anaconda area for 1978. The data listed is for the Highway Junction site some miles north of the Anaconda Company smelter. The data was obtained from hourly averages of wind speed and direction. The instrument was located on a small tripod on top of an air quality sampling trailer. The values in the tables are percent of occurrence for the category listed. The wind speed

categories are in meters per second (one meter per second = 2.2 miles per hour).

Reviewing briefly the data for 1978, the wind speeds in the Highway Junction area of the Deer Lodge Valley averaged monthly from 2.9 to 4.7 meters per second (m/sec). The late summer and late winter had the slowest average wind speeds. During the late summer about 24 percent of the winds were less than 1.5 m/sec (3.3 miles per hour). During the late winter this figure was about 36 percent. The windiest month was December (highest average wind speed). The average speed for December was 4.7 m/sec.

The wind direction data shows a slight predominance of southwest winds early in the year. The winds then shift to a slight predominance of west-northwest winds during the spring and eventually back to a west-southwest wind in the fall. The least frequent surface wind is from the southeast. However, during all months the wind blew from every direction of the compass. The wind speeds experienced at the Highway Junction site were about twice that at the Hebgen Park site in Butte. This higher wind speed in the Deer Lodge Valley creates better dispersion or flushing of the valley than occurring in Butte.

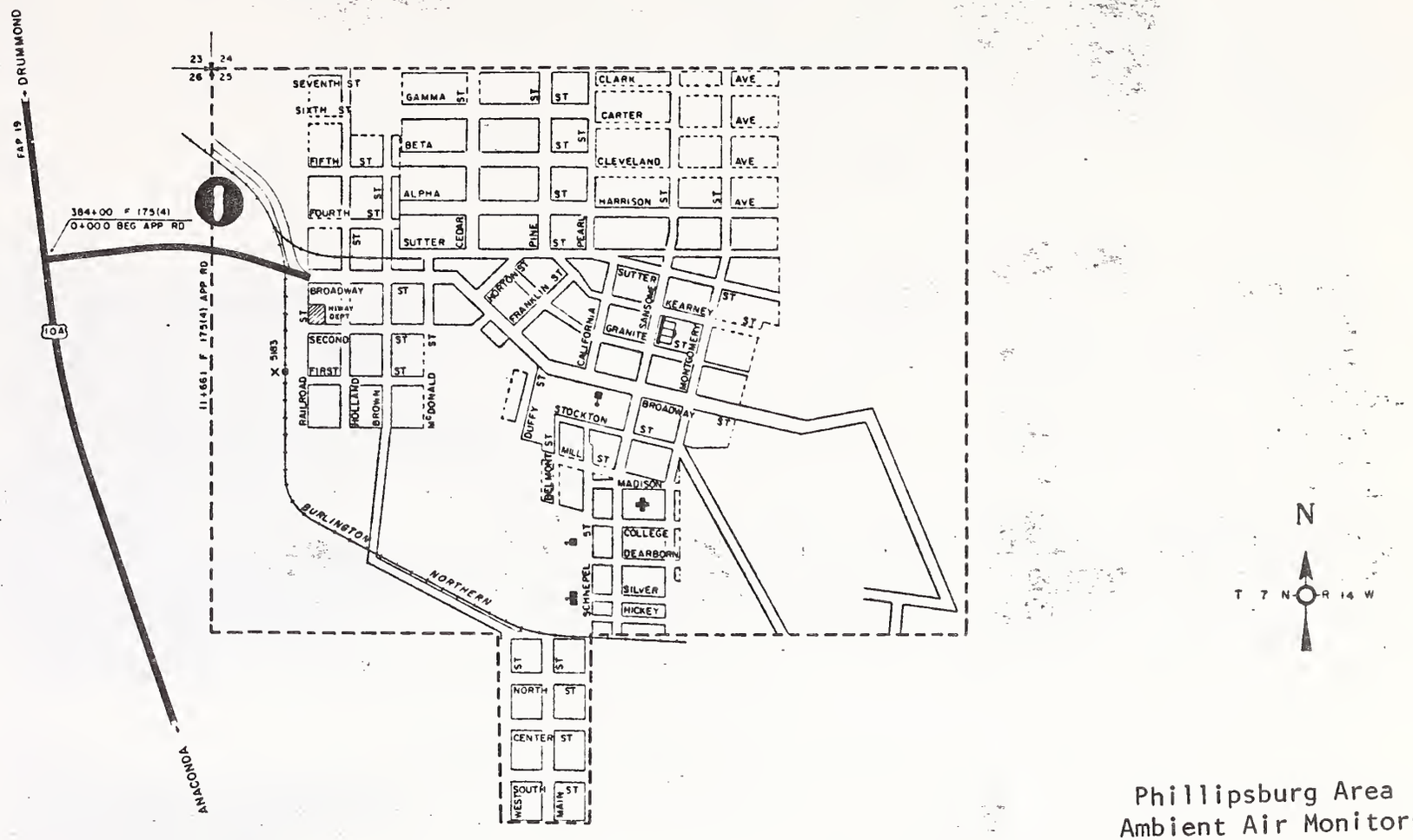


Anaconda Area
Ambient Air Monitors

Map No.	Site Name
1	Lincoln School
2	Courthouse
3	C - Hill
4	Highway Junction
5	Mill Creek

Major Point Source

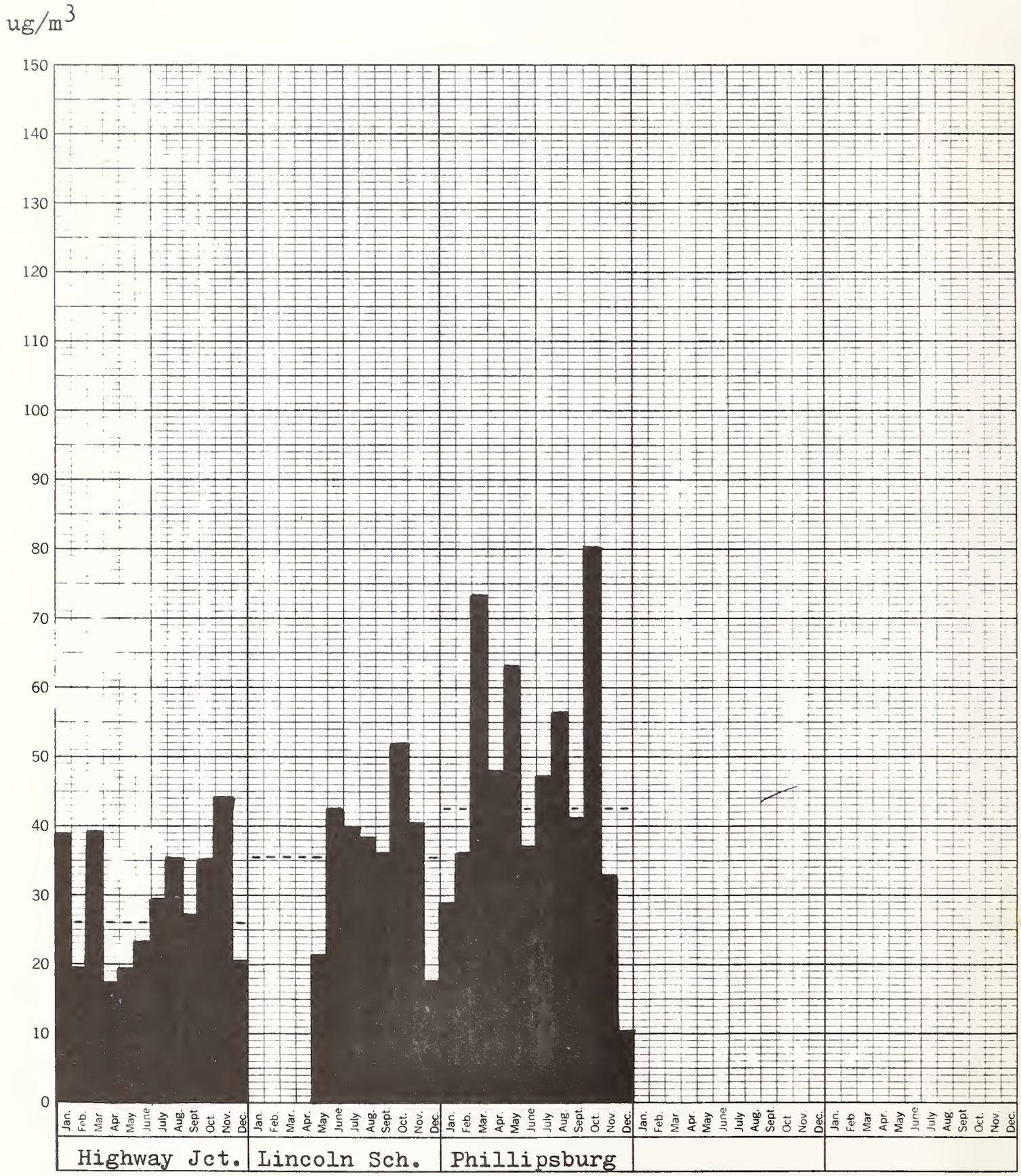
6	Anaconda Smelter



Phillipsburg Area
Ambient Air Monitors

Map No.	Site Name
1	Phillipsburg Site

Figure IV.A.2



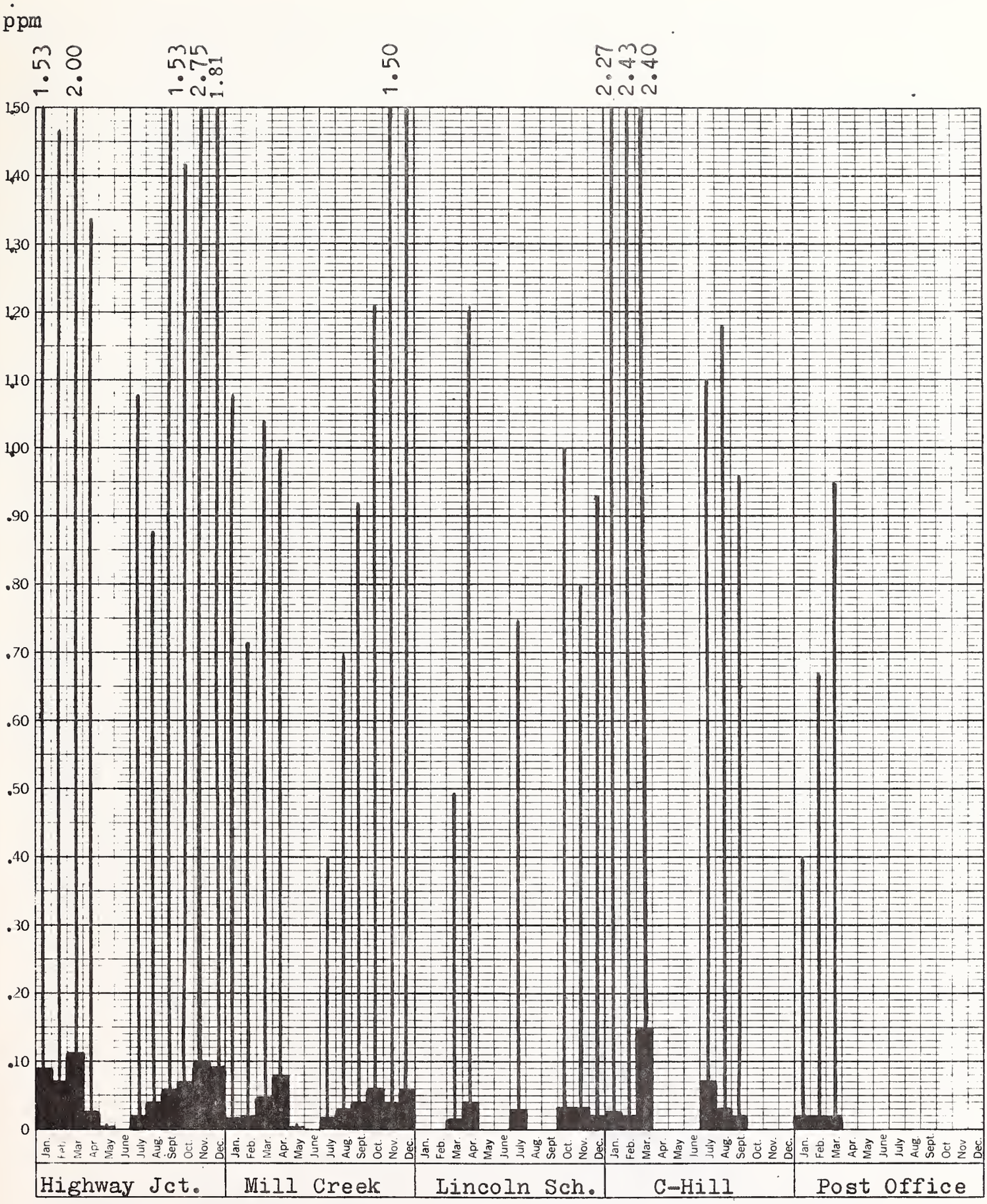
Location: Anaconda Area

Parameter: Total Suspended Particulate

Units: Micrograms/cubic meter

------: Annual Geometric Mean

Figure IV.A.3



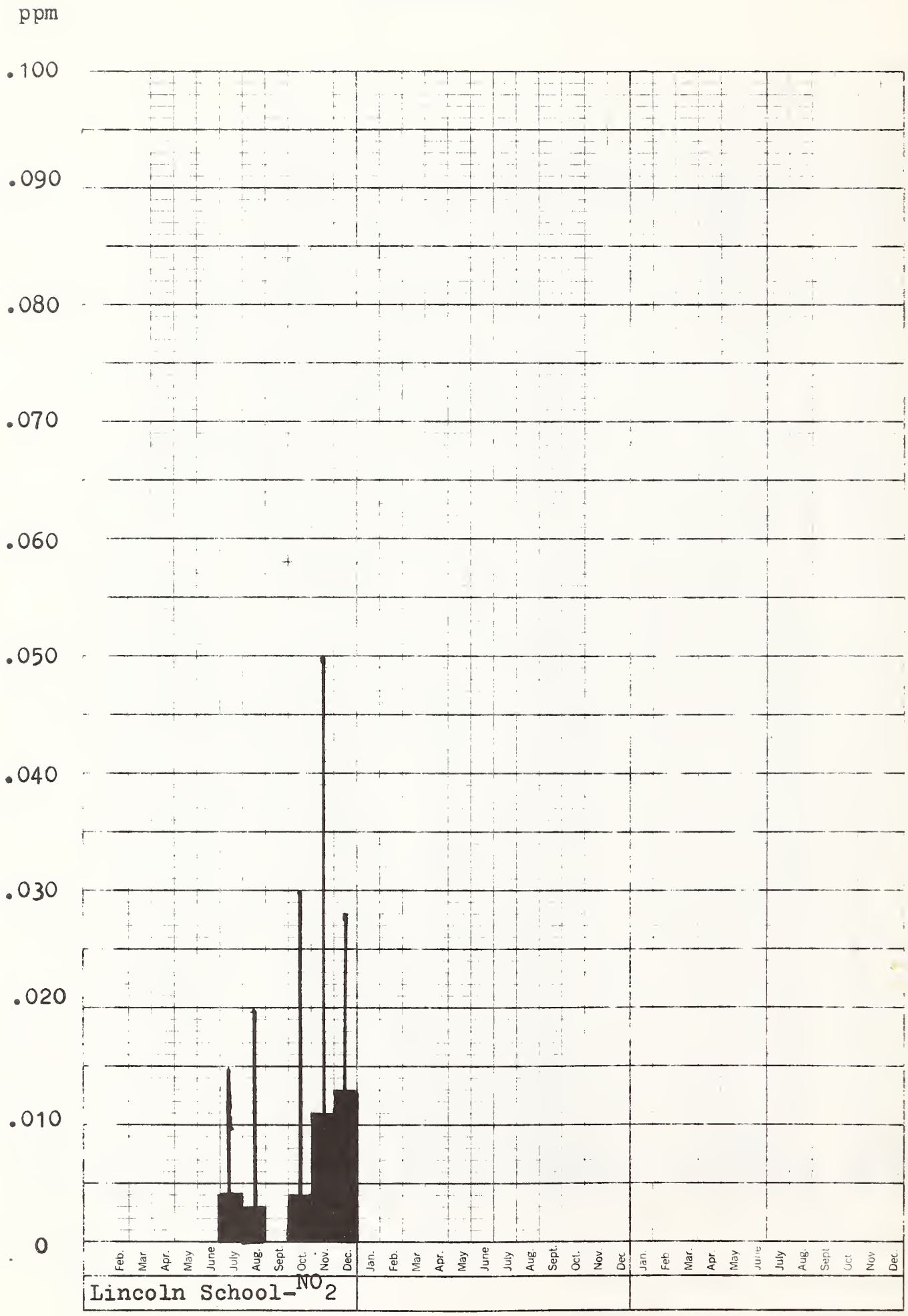
Location: Anaconda Area

Center Line: High Hour Reading

Parameter: Sulfur Dioxide

Units: Parts per million

Figure IV.A.4



Location: Anaconda Area

Center Line: High Hour Reading

Parameter: Nitrogen Dioxide

Units : Parts per million

TABLE IV.B.1

MONTHLY SUMMARY OF SURFACE WIND SPEED
Anaconda - Hiway Junction Site - 1978
(Values in percent of occurrence)

Speed (m/sec)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0.1 - 1.5	38.9	32.7	27.0	25.6	18.5	17.3	25.8	21.0	18.1	21.2	40.4	20.7
1.6 - 3.0	25.0	25.5	24.6	23.6	23.4	25.7	31.2	30.3	28.5	29.2	21.2	17.9
3.1 - 5.0	17.1	20.1	21.1	23.7	31.1	35.9	33.2	37.6	31.4	29.0	13.9	16.3
5.1 - 8.0	13.5	18.7	22.9	20.3	22.0	18.2	9.6	10.2	19.8	18.1	17.7	28.8
8.1 - 10.0	4.3	3.1	3.5	5.4	4.7	1.8	0.1	0.8	1.7	2.5	4.1	9.8
10.1 - 14.0	1.2	0.0	0.8	1.4	0.3	1.0	0.1	0.0	0.4	0.0	2.5	6.5
14.1 - 18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
18.1 - 22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Over 22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Speed (m/sec)	3.0	3.1	3.5	3.7	3.8	3.6	2.9	3.1	3.6	3.4	3.3	4.7

TABLE IV.B.2

MONTHLY SUMMARY OF SURFACE WIND DIRECTION
Anaconda - Hiway Junction Site - 1978
(Values in percent of occurrence)

Direction	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
N	6.2	3.7	1.3	2.7	2.6	1.6	4.6	1.4	1.6	3.0	2.3	3.8
NNE	8.1	12.4	5.6	7.1	8.8	3.4	0.6	3.9	4.4	3.2	12.2	6.6
NE	3.3	3.8	5.2	7.2	12.3	8.1	9.8	5.6	3.6	6.5	6.7	1.4
ENE	5.6	1.7	4.1	7.5	5.3	10.3	7.6	14.0	4.0	4.5	6.2	2.3
E	2.6	1.1	1.7	2.4	2.6	2.1	11.4	4.8	1.0	0.8	2.2	1.1
ESE	2.6	2.9	1.7	2.3	1.4	2.4	1.7	1.4	1.4	1.7	2.9	1.4
SE	2.2	1.5	1.8	2.5	0.8	1.5	3.3	1.4	2.0	0.7	2.8	0.8
SSE	4.3	10.6	4.8	7.2	2.2	3.9	4.3	3.6	8.1	3.0	4.6	4.4
S	2.6	3.5	2.7	2.3	2.6	2.1	3.7	1.3	3.3	2.5	3.0	2.7
SSW	11.6	11.5	10.0	3.1	6.8	6.4	1.0	3.2	10.1	8.8	13.6	12.7
SW	13.5	7.7	14.4	3.7	5.3	5.8	5.0	6.3	9.8	8.2	9.0	11.6
WSW	15.8	19.0	16.2	9.9	14.0	16.7	5.0	19.6	25.8	26.8	15.2	8.8
W	3.9	4.1	8.2	6.6	6.1	7.0	28.1	17.7	6.0	9.2	4.5	4.4
WNW	12.3	10.4	14.9	23.0	20.5	22.7	5.0	11.5	15.6	17.5	11.4	30.3
NW	2.5	3.2	6.5	9.8	7.3	3.4	7.8	2.8	1.6	2.1	1.3	5.1
NNW	2.9	2.8	1.1	2.8	1.4	2.4	1.2	1.4	1.7	1.4	2.0	2.9

V. MISSOULA AREA

A. Section V of this report concerns itself with the ambient air pollution monitoring data collected in the Missoula area. Data concerning total suspended particulate, sulfur dioxide, nitrogen dioxide, ozone, carbon monoxide, total hydrocarbons, respirable particulate and various meteorological parameters are discussed. The majority of the information is represented in the form of graphs and figures.

The elevation of the Missoula area is approximately 3,200 feet. Missoula is situated in the heart of the Montana Rocky Mountains. Missoula is at the center of two major valleys which has a heavy influence upon local meteorological conditions. The Continental Divide, 70 miles east of Missoula, and the Bitterroot Range, 20 miles southwest, significantly influence the area's meteorology. The area experiences frequent temperature inversions which tend to elevate concentrations of trapped pollutants.

The 1970 population of Missoula was 29,497 with a projected 1985 population of 33,300. The 1976 population of the entire county was 65,500 with a 1985 projected population of 74,100. The major business activities in the area are wood-product related. A pulp and paper mill, two plywood plants, a particle board plant and a number of sawmills all contribute to the air pollution of the area. Automobiles and home heating devices are also a concern.

1. Total Suspended Particulate

Figure V.A.1 shows the 1978 annual geometric mean and monthly averages of total suspended particulate for five selected sites in the Missoula area.

The sites selected were the Missoula County Courthouse in the downtown area, Johnson Bell Airfield west of town, Lion's Park at the corner of Bancroft and Kent, Hoerner-Waldorf #2 about 1 1/2 miles south of the Hoerner-Waldorf pulp and paper mill, and the Bonner #1 site at the State Forester's office about 3/4 miles southwest of Champion Building Products.

The Courthouse and Lion's Park sites recorded an annual geometric mean of 82.3 ug/m^3 and 81.8 ug/m^3 respectively. These levels are in violation of the national ambient air quality primary standard of 75 ug/m^3 annual geometric mean. The Johnson-Bell Field site recorded an annual geometric mean of 60.4 ug/m^3. The national secondary standard is 60 ug/m^3 annual geometric mean. There were numerous violations of the Montana 24-hour standard of 200 ug/m^3 at most sites.

The highest monthly average, 199.7 ug/m^3, was recorded at Lion's Park in March of 1978. The general trend at all five locations seems to show higher levels of total suspended particulate in the spring and fall with March and October tending to be particularly high. May and December tend to show low levels at most sites.

2. Sulfur Dioxide

Sulfur dioxide was monitored at the Lion's Park site from January through October of 1978. Relatively low levels of sulfur dioxide were recorded during that period. The highest monthly averages, .002 ppm, were recorded for February and March. The highest one-hour maximum concentration was .05 ppm, also in March. January recorded a monthly average of .001 ppm. All the remaining months monitored were below .001 ppm. There are no major sources of sulfur dioxide in the area. There were no violations of either state or national sulfur dioxide standards.

3. Nitrogen Dioxide

Nitrogen dioxide was monitored at Lion's Park from January through October of 1978. As can be seen in figure V.A.2, the nitrogen dioxide concentrations were highest in the fall, winter and early spring months with a sharp drop in the late spring and summer. The highest monthly average was .027 ppm for the month of February. The highest one-hour maximum, .098 ppm was also in February. The lowest levels were recorded in June with a monthly average of .01 ppm and a one-hour maximum of .033 ppm. Nitrogen dioxide levels in Missoula were all well below the national ambient air quality annual average standard of.05 ppm. Montana does not have a nitrogen dioxide standard at this time.

4. Ozone

Ozone was monitored at the Lion's Park site during the year 1978. The general trend for ozone showed a definite buildup during the summer months and lower levels through the fall, winter and spring. The highest monthly averages, .023 ppm, were recorded for June and July. The lowest monthly averages, .006 ppm, was for January. The maximum one-hour reading was .078 ppm recorded in September. This reading was well below the national ambient air quality primary one-hour standard of .12 ppm. Montana does not have an ozone standard at this time.

5. Carbon Monoxide

Carbon monoxide levels were monitored at Lion's Park and Malfunction Junction in Missoula during 1978. Malfunction Junction is the intersection of South Avenue, Brooks Street and Russell Street. It is an area of normally heavy automotive traffic. Ambient air concentrations of carbon monoxide were monitored at Malfunction Junction during the months of January, February,

April, May and June of 1978. The highest monthly average, 8.5 ppm, was recorded for February. The highest one-hour maximum level was 28.0 ppm in January.

Carbon monoxide was monitored at Lion's Park during the months of January, March and April of 1978. The highest monthly average, 8.2 ppm, was recorded for January with the highest one-hour maximum level, 24.0 ppm, the same month.

Not enough data is available for either site to indicate any real pattern, although both did record higher winter concentrations than spring. All carbon monoxide levels recorded were below the national ambient air quality one-hour standard of 35 ppm. Malfunction Junction recorded numerous violations of the national eight-hour standard of 9 ppm. Lion's Park recorded no violations of the national eight-hour standard. Montana does not have a carbon monoxide standard at this time.

6. Total Hydrocarbons

Total hydrocarbons were monitored at Lion's Park through 1978. Ambient air concentrations of total hydrocarbons remained relatively stable throughout the year. The highest monthly average recorded was 2.34 ppm for October. The lowest monthly average recorded was 1.79 ppm for the month of April. The highest one-hour reading was 8.13 ppm in August. There are no national or state ambient air quality total hydrocarbon standards at this time.

7. Particle size

Particle size distribution, using a dichotomous sampler, was monitored at Lion's Park in Missoula during the period of September through December of 1978. Particle size was measured in three ranges: 1. fine particulate of less than 2.5 microns; 2. coarse particulate of between 2.5 and 15 microns; and 3. respirable particulate of less than 15 microns (i.e. sum of 1 and 2).

The Lion's Park dichotomous sampler recorded an average of 29.8 ug/m^3 for fine particulate, 30.3 ug/m^3 for coarse particulate and 60.1 ug/m^3 for respirable particulate.

This particular device is of special interest since it is this size of particles that has the greatest potential impact upon the lungs. The data is preliminary at this point and as such the meaning of these numbers is unclear. No national or state standards yet exist for this pollutant.

B. Missoula Area Wind Summary

Tables V.B.1 and V.B.2 summarize the wind speed and direction for the Missoula area for 1978. The data listed is for the Lyon's Park site in Missoula. The data was obtained from hourly averages of wind speed and direction. The instrument was located on a 30-foot tower next to an air quality sampling trailer. The values in the tables are in percent of occurrence for the cateogry listed. The wind speed categories are in meters per second (m/sec).

Briefly examining the data the wind speed data shows an average monthly wind speed ranging from 1.1 to 2.1 m/sec. The highest average wind speeds occurred in the April through June period. The lowest wind speeds occurred during January and February. During January and February over 83 percent of the wind speeds were under 1.6 m/sec. In the April through June period this figure had dropped to 52 percent.

The wind direction data shows a slight predominance of southwesterly winds during the entire year. However winds of every direction occurred at some time during the year. During the winter season when the slowest average wind speeds occurred the wind directions were predominantly south-southwest. During the spring and early summer the predominance of wind directions were more westerly.

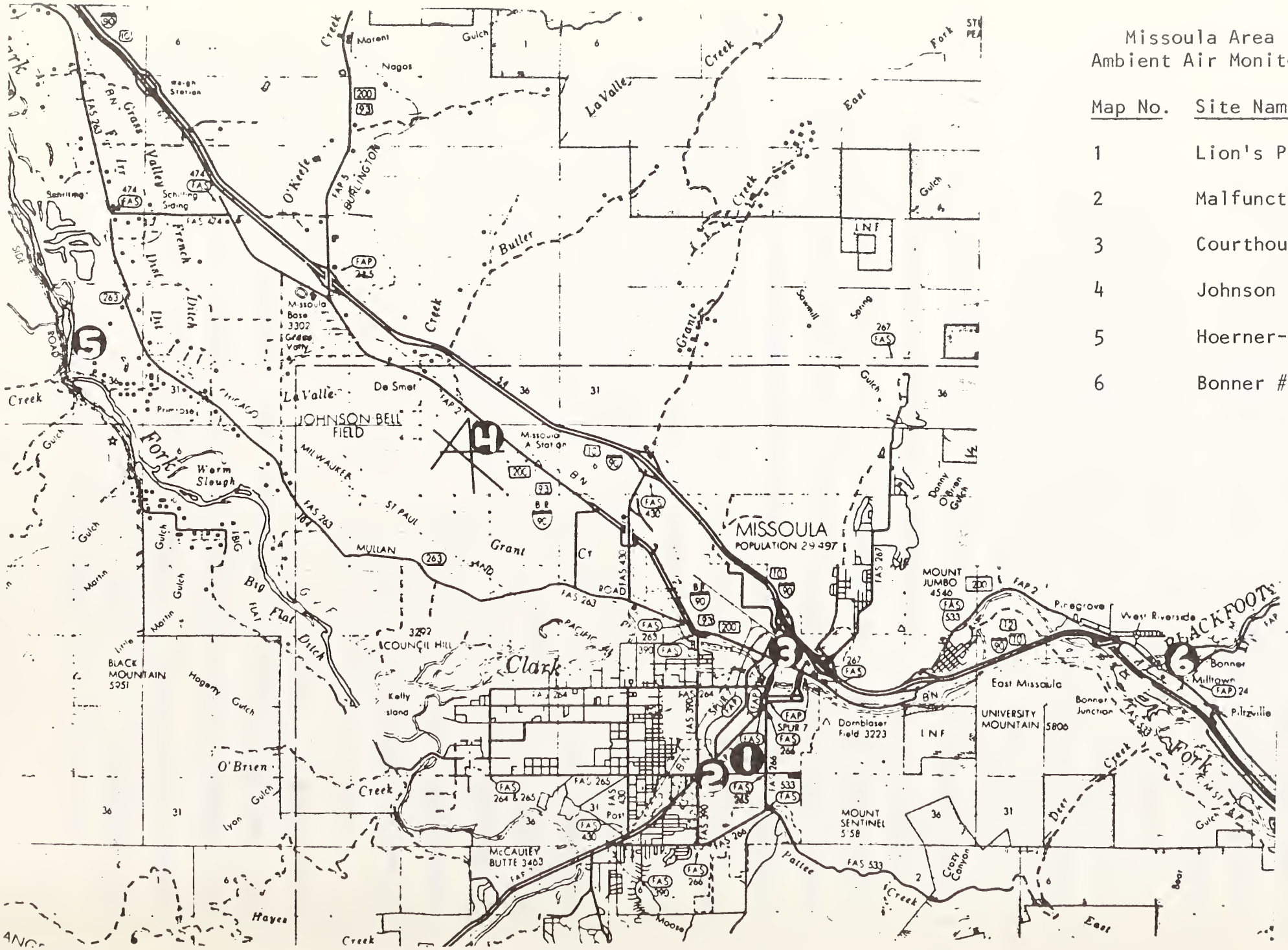
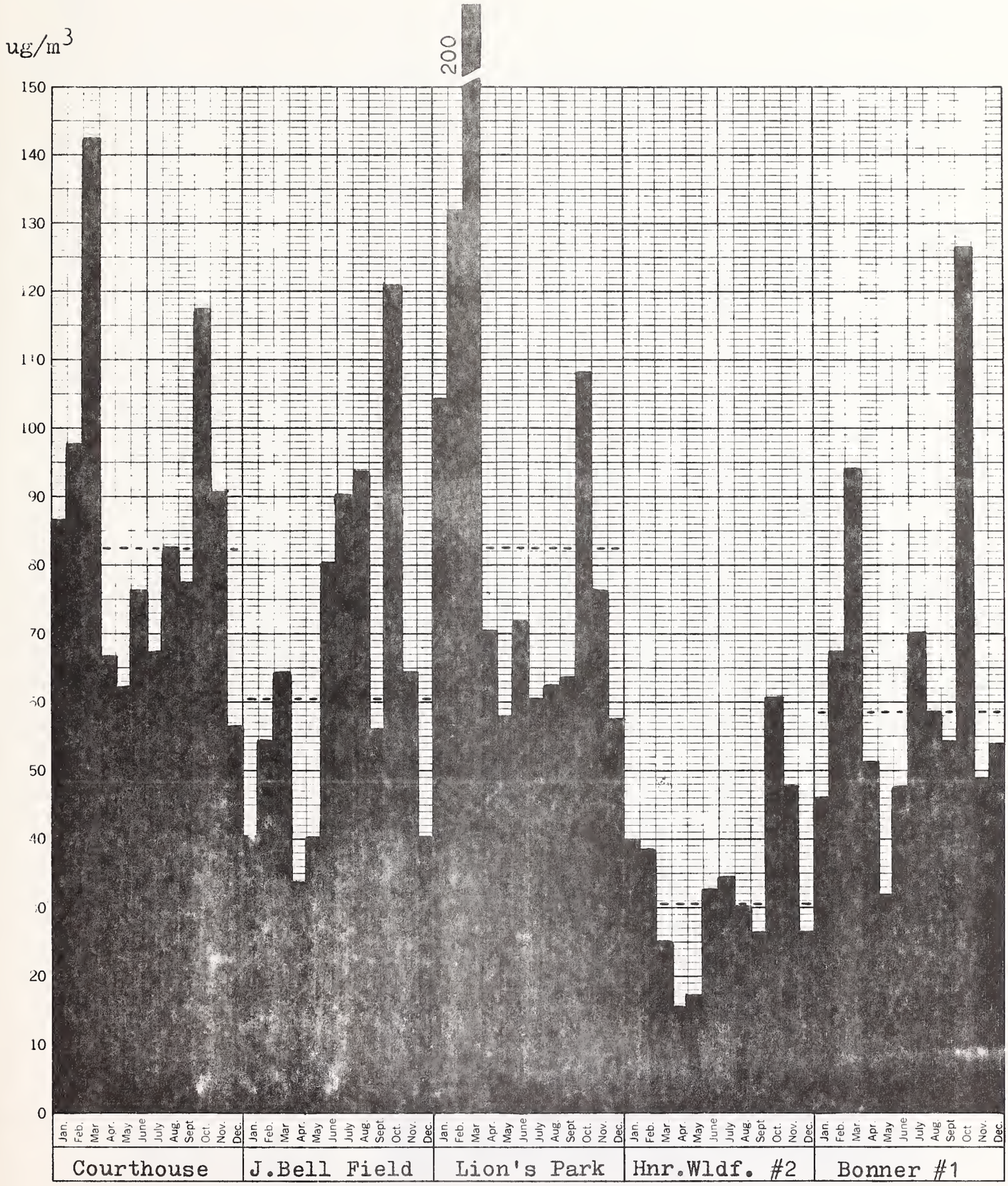

MISSOULA
POPULATION 29 497
JOHNSON BELL FIELD
Clark
Fork
Missoula Area
Ambient Air Monitors
Map No. Site Name
1 Lion's Park
2 Malfunction Jct.
3 Courthouse
4 Johnson Bell Field
5 Hoerner-Waldorf #2
6 Bonner #1

Figure V.A.2



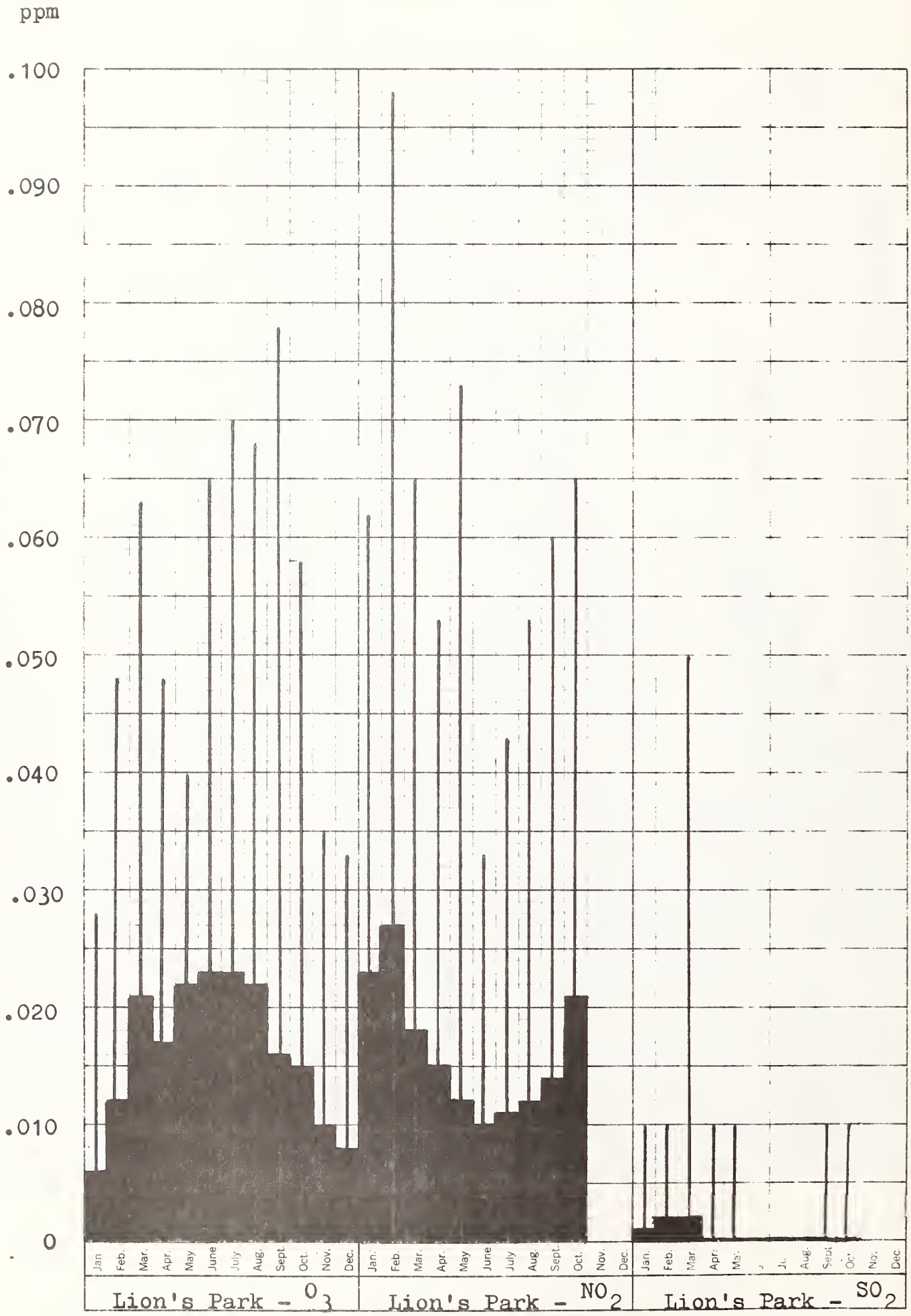
Location: Missoula Area

Parameter: Total Suspended Particulate

Units: Micrograms/cubic meter

------: Annual Geometric Mean

Figure V.A.3

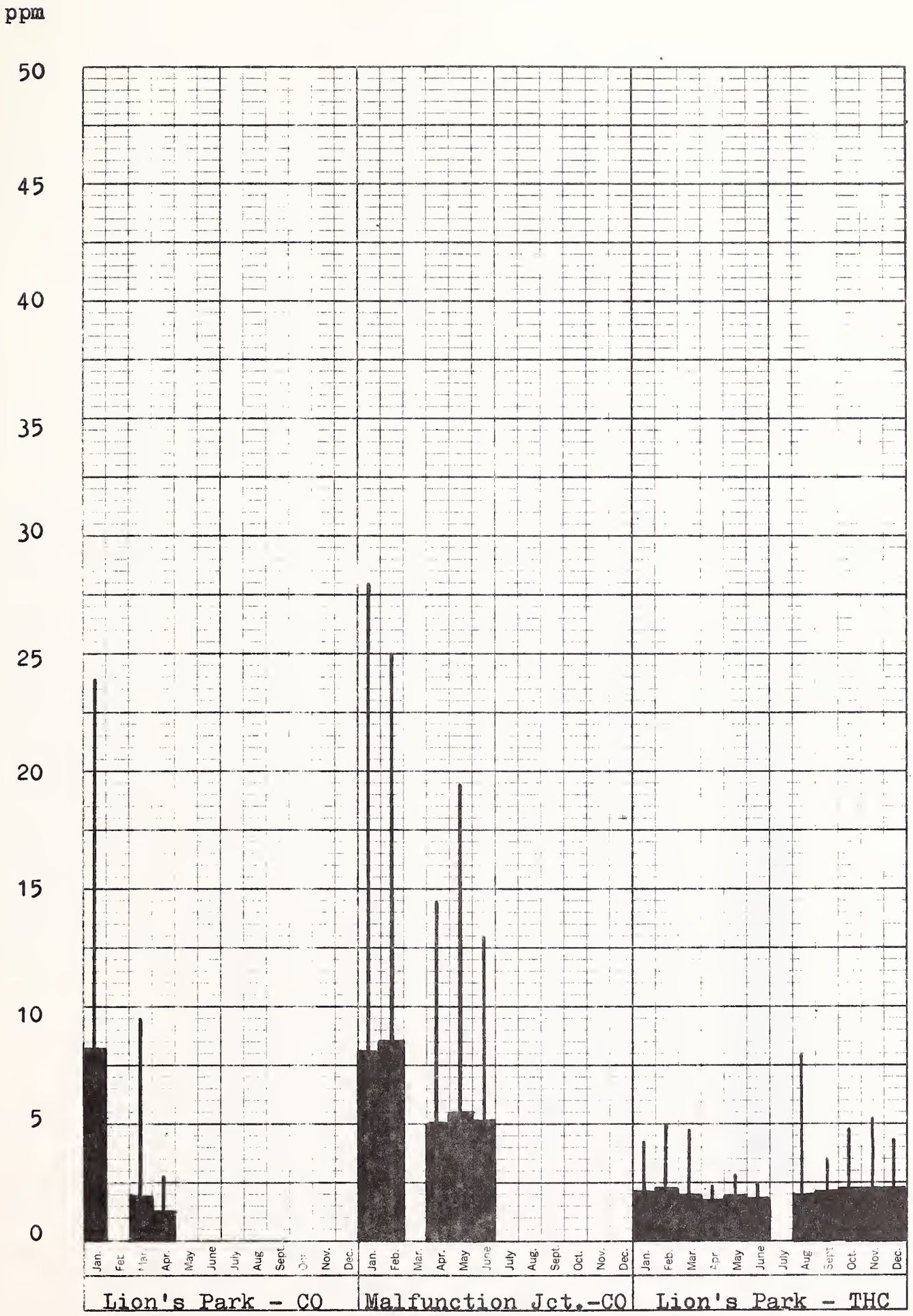


Location: Missoula Area Center Line: High Hour Reading

Parameter: Ozone, Nitrogen Dioxide & Sulfur Dioxide

Units: Parts per million

Figure V.A.4

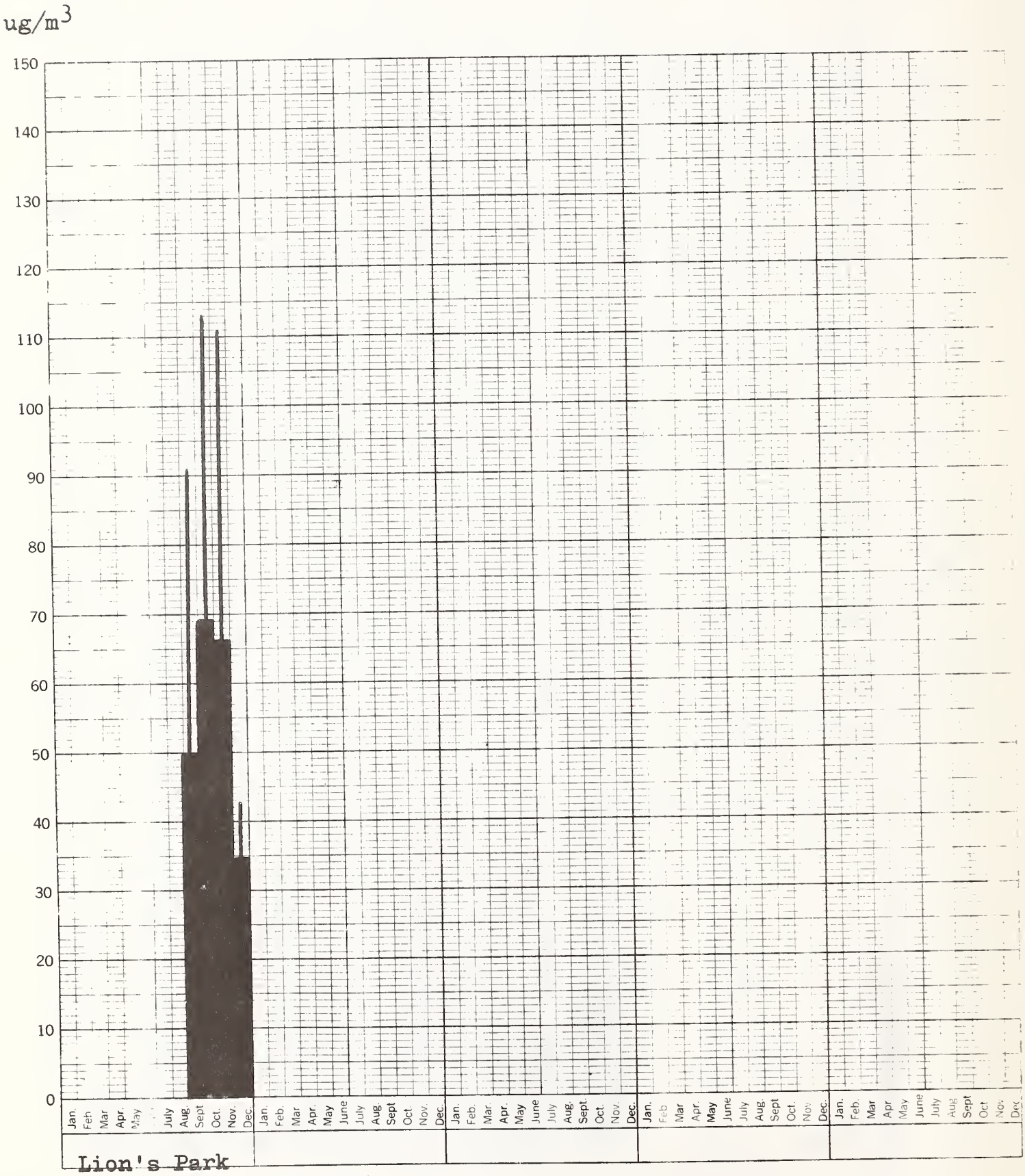


Location: Missoula Area Center Line: High Hour Reading

Parameter: Carbon Monoxide & Total Hydrocarbons

Units: Parts per million

Figure V.A.5



Location: Missoula Area

Parameter: Respirable Particulate

Units: Micrograms/cubic meter

Center Line: High Hour Reading

TABLE V.B.1

MONTHLY SUMMARY OF SURFACE WIND SPEED
Missoula - Lyon's Park Site - 1978
(Values in percent of occurrence)

Speed (m/sec)	Jan.	Feb.	Mar.	Apr.	May	June *	July	Aug.	Sept. *	Oct.	Nov.	Dec. *
0.1 - 1.5	81.3	85.1	69.4	47.5	54.1	54.8	-	-	64.5	67.9	73.6	67.1
1.6 - 3.0	11.7	12.1	17.0	29.3	23.6	21.6	-	-	12.7	12.1	10.1	11.6
3.1 - 5.0	6.3	2.8	10.8	17.9	18.5	20.1	-	-	17.9	14.4	11.5	16.4
5.1 - 8.0	0.6	0.0	2.7	5.2	3.9	3.5	-	-	4.9	5.1	3.4	4.8
8.1 - 10.0	0.0	0.0	0.0	0.1	0.0	0.0	-	-	0.0	0.2	1.4	0.0
10.1 - 14.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0
14.1 - 18.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0
18.1 - 22.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0
Over 22.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	0.0	0.2	0.0	0.0
Average Speed (m/sec)	1.1	1.1	1.6	2.1	2.0	2.0	-	-	1.7	1.5	1.4	1.8

* Less than full month of data.

TABLE V.B.2

MONTHLY SUMMARY OF SURFACE WIND DIRECTION
Missoula - Lyon's Park Site - 1978
(Values in percent of occurrence)

Direction	Jan.	Feb.	Mar.	Apr.	May	June*	July	Aug.	Sept.*	Oct.	Nov.	Dec.
N	3.6	3.5	1.7	3.7	4.7	30.3	-	-	1.8	5.4	2.6	1.4
NNE	4.8	3.4	2.9	1.8	2.7	0.0	-	-	2.6	1.6	2.4	0.5
NE	2.3	1.7	1.2	1.6	1.6	0.0	-	-	4.2	2.8	1.7	2.9
ENE	10.0	6.7	7.5	7.6	4.4	0.9	-	-	3.4	0.9	2.4	2.4
E	3.7	8.4	9.1	4.5	3.8	2.6	-	-	2.6	2.8	9.9	2.9
ESE	6.3	9.3	10.2	9.6	6.5	9.0	-	-	5.7	6.5	4.6	2.9
SE	1.8	3.2	3.4	3.3	3.8	6.1	-	-	9.3	11.6	7.2	3.4
SSE	5.9	9.8	7.9	5.8	5.5	13.4	-	-	5.2	5.1	1.7	4.4
S	4.8	5.2	5.2	3.3	5.2	7.0	-	-	4.9	6.7	6.5	8.2
SSW	17.5	13.9	8.2	7.9	10.5	7.9	-	-	9.1	11.9	7.7	5.3
SW	6.3	8.4	5.0	6.0	5.0	3.8	-	-	12.4	11.6	12.7	12.1
WSW	9.7	11.3	10.4	13.7	11.4	4.7	-	-	7.8	9.5	10.3	10.6
W	5.3	3.9	7.3	7.5	10.4	2.6	-	-	10.1	6.5	13.0	24.6
WNW	7.0	6.0	7.8	7.9	8.9	5.8	-	-	7.8	5.6	3.8	8.7
NW	4.3	2.0	5.3	5.5	5.8	1.5	-	-	9.8	4.9	8.9	4.8
NNW	6.6	3.4	7.0	10.3	9.6	4.4	-	-	3.4	6.5	4.6	4.8

* Less than full month of data

VI. FLATHEAD AREA

A. This section of the report deals with ambient air monitoring data collected in the northwestern section of Montana. This area of the state includes Kalispell, Libby, Columbia Falls, Thompson Falls and Moose City. Data concerning total suspended particulate, and various meteorological parameters are discussed. A great deal of the data is in the form of graphs and figures.

The northwestern portion of Montana lies in the Northern Rocky Mountains. Elevation of the area varies from less than 2,000 feet to more than 10,000 feet. The terrain varies from low elevation, fertile valleys to alpine wilderness. The climate is as varied as the elevation and the terrain. The centers of population, mostly in the larger valleys, tend to have milder climates than most areas of the state.

Potential sources of air pollution in the area include The Anaconda Aluminum Plant at Columbia Falls, St. Regis Lumber at Libby and a variety of wood-products enterprises throughout the region.

1. Total Suspended Particulate

Total suspended particulates were monitored at five sites in the Flathead area during 1978. The Columbia Falls site, approximately two miles southwest of the Anaconda Aluminum Plant, recorded an annual geometric mean of 96.1 ug/m^3. The highest monthly average was 233 ug/m^3 for the month of March.

The Moose City site is located on the U.S. - Canadian border on the west boundary of Glacier National Park. This site was in operation during the months of September, October and December of 1978. The geometric mean for

that period was 10.8 ug/m^3. The highest monthly average was 21 ug/m^3 for the month of October.

The Kalispell site, located in the town of Kalispell, recorded an annual geometric mean of 81.0 ug/m^3 and a high monthly average of 169 ug/m^3 for March.

The Libby site, located 1/2 block west of St. Regis Lumber, recorded the highest annual geometric mean, 131.5 ug/m^3, of any site in the state. The high monthly average, also the highest in the state, was 639 ug/m^3.

The Thompson Falls site, one mile east of town near the Pack River Lumber Mill, operated from August through December of 1978. The annual geometric mean was 50.8 ug/m^3. The highest monthly average was 97 ug/m^3 for October.

The Columbia Falls, Kalispell and Libby sites were all in violation of the national ambient air quality primary annual geometric mean standard of 75 ug/m^3. These sites all recorded numerous violations of the state 24-hour standard of 200 ug/m^3. The general pattern at these sites showed elevated total suspended particulate levels during the spring, summer and fall months and lower concentration during the winter.

B. Kalispell Area Wind Summary

Tables VI.B.1 and VI.B.2 summarize the wind speed and direction for the Kalispell area for 1978. Tables VI.B.3 and VI.B.4 summarize the same data for the Columbia Falls area. The data listed in the Kalispell summary are for the Glacier International Airport site some seven miles north of Kalispell. The Columbia Falls data was taken from the Columbia Falls Water Supply site about one mile north of Columbia Falls. The data from all the tables was obtained from hourly averages of wind speed and direction. The instruments were located on thirty foot towers next to air quality sampling trailers.

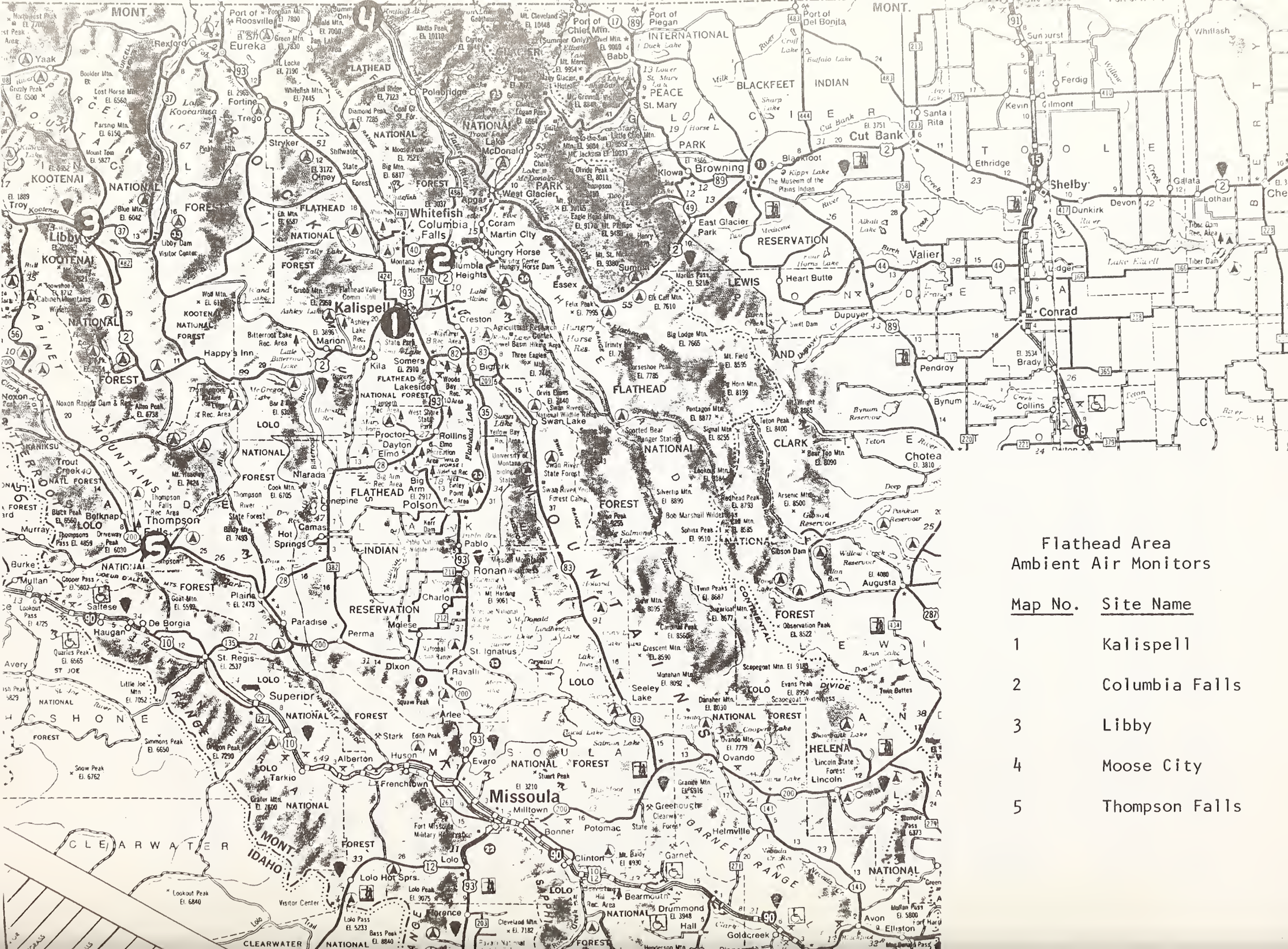
The values in the tables are in percent of occurrence for the category listed. The wind speed categories are in meters per second (one meter per second = 2.2 miles per hour).

Briefly the data for the Kalispell area during 1978 shows an average monthly wind speed from 1.3 to 2.8 meters per second (m/sec). The spring season (March through May) had the slowest average wind speeds (1.4 m/sec) whereas the normal season experiencing the slowest wind speeds (fall season) had an average wind speed of 2.3 m/sec. The windiest month was November, having an average wind speed of 2.8 m/sec. The wind speeds compare very closely to that experienced in Butte (Section III.B).

The wind direction data for the Kalispell area showed a predominant southerly wind during all months during 1978. During the summer this southerly wind was most predominant occurring over 47 percent of the time in June. This southerly wind is caused primarily by the Flathead Lake to the south of Kalispell. The least frequent wind direction was from the east or east-southeast.

The data for the Columbia Falls site showed a slightly stronger wind speed. The average monthly values ranged from 1.6 m/sec in August to 4.3 m/sec in April. The early fall season had the slowest average wind speeds whereas the spring and early winter seasons had the strongest wind speeds.

The wind direction data for the Water Supply site showed a bipolar frequency caused by the upslope and downslope winds of the area. The evening and early morning winds were predominantly from the north or northwest whereas the daytime winds were from the southwest. This upslope-downslope wind occurred primarily from March through October. The least frequent wind direction was from west-southwest and the east-southeast.


Kalispell
Columbia Falls
Libby
Moose City
Thompson Falls
Missoula
Whitefish
Polson
Ronan
Superior
Eureka
Conrad
Shelby
Cut Bank
Browning
Helena
Lincoln
Augusta
Chester
Havre
Glacier National Park
Flathead Lake
Swan Lake
Lake McDonald
Hungry Horse Reservoir
Bitterroot Lake
Lake Elwell
Tiber Dam
Bynum Reservoir
Gibson Reservoir
Willow Creek Reservoir
Canyon Reservoir
Blackfeet Indian Reservoir
Kipps Lake
Cooper Lake
Swan River State Forest
Swan River Forest Camp
Salmon Lake
Seeley Lake
Ovando
Helmville
Garnet
Drummond
Bearmouth
Clinton
Potomac
Bonner
Milltown
Frenchtown
Huson
Alberton
Superior
Plains
Paradise
Perma
Dixon
St. Ignatius
Ravalli
Charlo
Moiese
Pablo
Dayton
Proctor
Rollins
Somers
Bigfork
Creston
Kila
Marion
Lakeside
Hungry Horse
Coram
Martin City
West Glacier
Apgar
Essex
Columbia Heights
Happy's Inn
Noxon
Trout Creek
Thompson Falls
Camas Hot Springs
Saltese
Haugan
De Borgia
St. Regis
Lolo Hot Sprs.
Florence
Lolo
Stevensville
Hamilton
Darby
Sula
Conrad
Dupuyer
Pendroy
Brady
Bynum
Collins
Chotea
Dunkirk
Devon
Galata
Lothair
Ethridge
Kevin
Sunburst
Whitlash
Ferdig
Gilmont
Santa Rita
Blackfoot
Kiowa
East Glacier Park
Heart Butte
Valier
Ledger
Augusta
Lincoln
Helena
Avon
Ellston
Goldcreek
Hall
Drummond
Bearmouth
Greenough
Clearwater State Forest
Lolo Pass
Lolo Peak
Bass Peak
Cleveland Mtn.
Visitor Center
Lookout Peak
Snow Peak
Summers Peak
Quartz Peak
Saddle Mtn.
Mt. Cleveland
Port of Chief Mtn.
Port of Piegan
Port of Del Bonita
Port of Roosville
Port of Babb
Port of Eureka
Port of Polebridge
Port of Fortine
Port of Trego
Port of Stryker
Port of Olney
Port of Libby
Port of Troy
Port of Yaak
Port of Rexford
Port of Noxon
Port of Thompson Falls
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Port of Milltown
Port of Bonner
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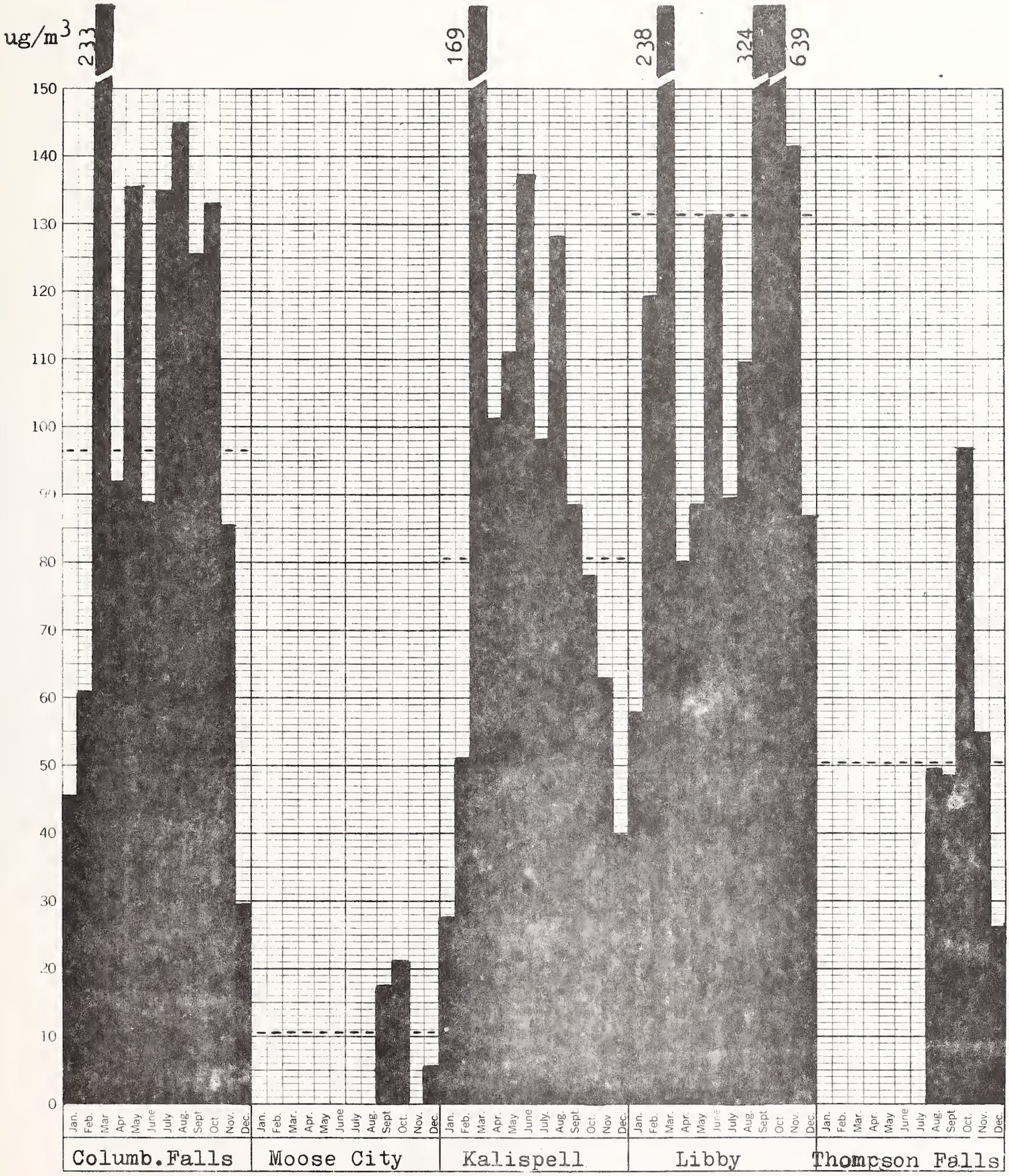
Figure VI.A.2



Location: Flathead Area

Parameter: Total Suspended Particulate

Units: Micrograms/cubic meter

------: Annual Geometric Mean

TABLE VI.B.1

MONTHLY SUMMARY OF SURFACE WIND SPEED
Kalispell - Airport Site - 1978
(Values in percent of occurrence)

Speed (m/sec)	Jan.	Feb.	Mar.	Apr.	May	June*	July	Aug.	Sept.	Oct.	Nov.	Dec.
0.1 - 1.5	--	48.0	67.6	63.8	70.8	47.0	47.3	53.3	53.3	65.6	56.8	50.3
1.6 - 3.0	--	18.0	20.2	27.2	25.5	20.5	22.8	26.7	21.4	16.9	10.3	15.3
3.1 - 5.0	--	20.8	10.7	8.9	3.7	21.1	22.4	14.3	19.3	10.9	14.5	19.1
5.1 - 8.0	--	8.9	1.4	0.1	0.0	10.2	6.9	4.6	5.7	5.5	9.6	11.5
8.1 - 10.0	--	2.7	0.0	0.0	0.0	1.2	0.6	0.6	0.3	1.1	5.2	2.5
10.1 - 14.0	--	1.5	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	3.4	1.4
14.1 - 18.0	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
18.1 - 22.0	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Over 22.0	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Speed (m/sec)	--	2.6	1.4	1.5	1.3	2.4	2.3	2.1	2.2	1.9	2.8	2.7

* Less than full month of data.

MONTHLY SUMMARY OF SURFACE WIND DIRECTION
Kalispell - Airport Site - 1978
(Values in percent of occurrence)

Direction	Jan.	Feb.	Mar.	Apr.	May	June*	July	Aug.	Sept.	Oct.	Nov.	Dec.
N	--	5.7	11.3	10.8	8.5	5.4	8.8	8.4	6.8	9.4	7.6	4.9
NNE	--	15.6	10.5	15.6	6.6	4.2	10.5	6.6	4.5	8.0	15.5	11.1
NE	--	5.0	5.3	11.8	5.4	7.8	6.3	5.8	4.8	5.0	4.5	3.1
ENE	--	2.2	0.6	1.2	1.2	3.0	2.4	0.8	1.7	3.0	1.7	1.7
E	--	1.2	1.2	0.7	1.0	2.4	2.2	1.6	1.0	1.5	1.4	0.7
ESE	--	1.5	0.8	0.2	0.9	0.0	0.3	1.1	1.1	1.6	1.7	2.0
SE	--	8.4	1.6	1.9	0.9	0.6	1.0	3.8	8.8	3.3	7.1	7.0
SSE	--	17.4	7.3	7.1	5.9	14.5	9.4	9.8	14.6	9.5	12.6	14.6
S	--	10.7	18.4	19.0	22.0	33.1	24.9	16.2	11.4	10.2	8.3	10.1
SSW	--	8.6	9.1	4.8	10.7	3.6	3.8	7.2	7.5	9.1	12.2	9.2
SW	--	5.9	8.7	6.8	12.2	7.2	4.9	9.6	6.7	7.6	7.9	7.4
WSW	--	4.0	6.9	4.1	5.9	6.0	3.8	5.2	6.7	6.2	3.2	6.0
W	--	4.0	6.9	4.5	5.4	3.0	5.3	5.2	6.7	5.8	5.5	4.8
WNW	--	1.7	4.2	4.1	2.5	1.2	5.2	4.2	4.8	6.5	3.7	6.4
NW	--	3.7	3.4	3.8	3.7	3.0	6.2	8.2	5.8	5.8	3.2	4.0
NNW	--	4.4	3.6	3.8	7.3	4.8	5.0	6.3	7.1	7.6	3.8	7.2

* Less than full month of data.

TABLE VI.B.3

MONTHLY SUMMARY OF SURFACE WIND SPEED
Columbia Falls - Water Supply Site - 1978
(Values in percent of occurrence)

	Jan.	Feb.	Mar.	Apr.	May	June*	July*	Aug.*	Sept.	Oct.	Nov.	Dec.*
Speed (m/sec)												
0.1 - 1.5	48.9	46.0	31.0	9.7	14.2	40.9	57.5	63.1	54.6	43.7	40.0	31.9
1.6 - 3.0	22.5	25.9	39.3	29.6	43.7	36.7	24.2	30.5	35.4	49.7	21.3	23.5
3.1 - 5.0	14.0	14.2	18.4	33.8	35.1	16.2	8.6	5.3	7.3	4.8	19.1	22.1
5.1 - 8.0	6.4	4.4	6.0	15.3	7.0	3.6	8.6	1.1	2.0	1.8	12.5	12.2
8.1 - 10.0	2.9	2.3	2.1	7.8	0.0	2.6	1.1	0.0	0.4	0.0	2.8	9.4
10.1 - 14.0	4.6	5.5	3.2	3.9	0.0	0.0	0.0	0.0	0.3	0.0	2.2	0.9
14.1 - 18.0	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0
18.1 - 22.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Over 22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Speed (m/sec)	2.8	3.1	3.0	4.3	3.0	2.2	2.2	1.6	1.8	1.9	3.3	3.3

* Less than full month of data.

TABLE VI.B.4

MONTHLY SUMMARY OF SURFACE WIND DIRECTION
Columbia Falls - Water Supply Site - 1978
(Values in percent of occurrence)

Direction	Jan.	Feb.	Mar.	Apr.	May	June*	July*	Aug.*	Sept.	Oct.	Nov.	Dec.*
N	13.0	14.9	30.9	19.8	29.9	34.7	35.0	4.3	5.4	2.0	8.3	4.2
NNE	5.7	4.4	5.0	6.2	7.3	6.2	4.3	0.0	2.1	1.2	3.1	7.5
NE	4.8	1.5	6.7	2.2	2.2	6.2	3.2	1.1	0.6	0.6	6.2	5.6
ENE	8.0	4.0	2.6	3.0	1.9	2.0	2.2	0.5	1.1	1.4	7.9	2.8
E	9.1	7.6	5.9	17.8	2.4	2.6	3.8	0.0	1.4	0.8	3.7	3.8
ESE	4.8	3.2	3.0	4.2	0.6	2.0	7.5	1.1	0.6	0.6	1.3	0.9
SE	2.4	5.0	1.8	1.9	0.4	1.3	0.5	2.7	4.3	4.4	4.2	5.2
SSE	1.3	8.8	2.1	0.6	1.0	2.3	2.2	7.0	11.8	8.1	8.4	8.4
S	2.2	17.5	6.3	10.4	12.4	3.6	7.5	12.3	11.7	8.5	14.9	19.2
SSW	5.5	4.1	8.0	13.3	21.9	14.6	10.2	5.9	1.8	3.0	1.1	3.3
SW	2.9	2.7	5.4	7.1	5.8	12.3	11.8	1.6	1.6	3.4	1.1	3.3
WSW	9.1	1.7	2.6	1.2	1.6	2.9	3.2	1.1	1.1	1.2	1.3	1.4
W	10.8	2.9	7.4	3.3	2.8	2.0	1.1	4.8	1.8	1.6	1.3	2.4
WNW	9.0	3.8	3.3	1.2	0.9	0.6	2.2	6.4	3.0	2.3	1.8	4.7
NW	3.9	8.5	3.0	2.9	1.6	2.3	2.2	39.6	35.0	32.0	16.5	19.2
NNW	7.6	9.2	6.0	5.2	7.1	4.5	3.2	11.8	16.6	29.0	18.9	8.0

* Less than full month of data.

VII POPLAR RIVER AREA

A. This section of the report concerns itself with data collected in the northeast section of Montana. Data concerning total suspended particulate and various meterological parameters will be discussed. A great deal of the data is represented in the form of graphs and figures.

The poplar River study area includes the towns of Scobey and Fort Peck. This area of the state is part of the northern Great Plains and varies in elevation from approximately 1,900 feet to approximately 2,500 feet. The climate is characterized by hard, cold winters and high, persistant winds. The area is predominantly agricultural and sparsely populated. The town of Scobey had a 1970 population of 1486 and is estimated to be 1450 in 1985. Fort Peck had a 1970 population of 625.

There are no major sources of air pollution in this area at this time outside of plowed fields. The main purpose of ambient air monitoring in the region is to establish background levels of pollution prior to the completion and operation of a Canadian coal-fired electrical generating plant a few miles north of the U.S.-Canadian border north of Scobey. The plant is scheduled to go into operation in the fall of 1979.

1. Total Suspended Particulate

Total suspended particulate was monitored at 4 sites in the Poplar River area during 1978. All four sites were in operation throughout the year. The Scobey border site is on the U.S.-Canadian border, approximately 14 miles north of Scobey. The border site recorded an annual geometric mean of 12.4 ug/m^3. The highest monthly average recorded was 26 ug/m^3 for July. The

lowest monthly average recorded was 5 ug/m^3 for March.

The Scobey Richardson site is one mile north of the town of Scobey. This location recorded an annual geometric mean of 15.7 ug/m^3 with a high monthly average of 33 ug/m^3 for August. The Scobey Engberg site is about eight miles north of Scobey. The annual geometric mean at the Engberg site was 16.7 ug/m^3 with a high monthly average of 42 ug/m^3 for the month of August.

The Fort Peck site is located approximately three miles west of the town of Fort Peck. This site recorded an annual geometric mean of 11.9 ug/m^3 and a high monthly average of 31 ug/m^3 for the month of August.

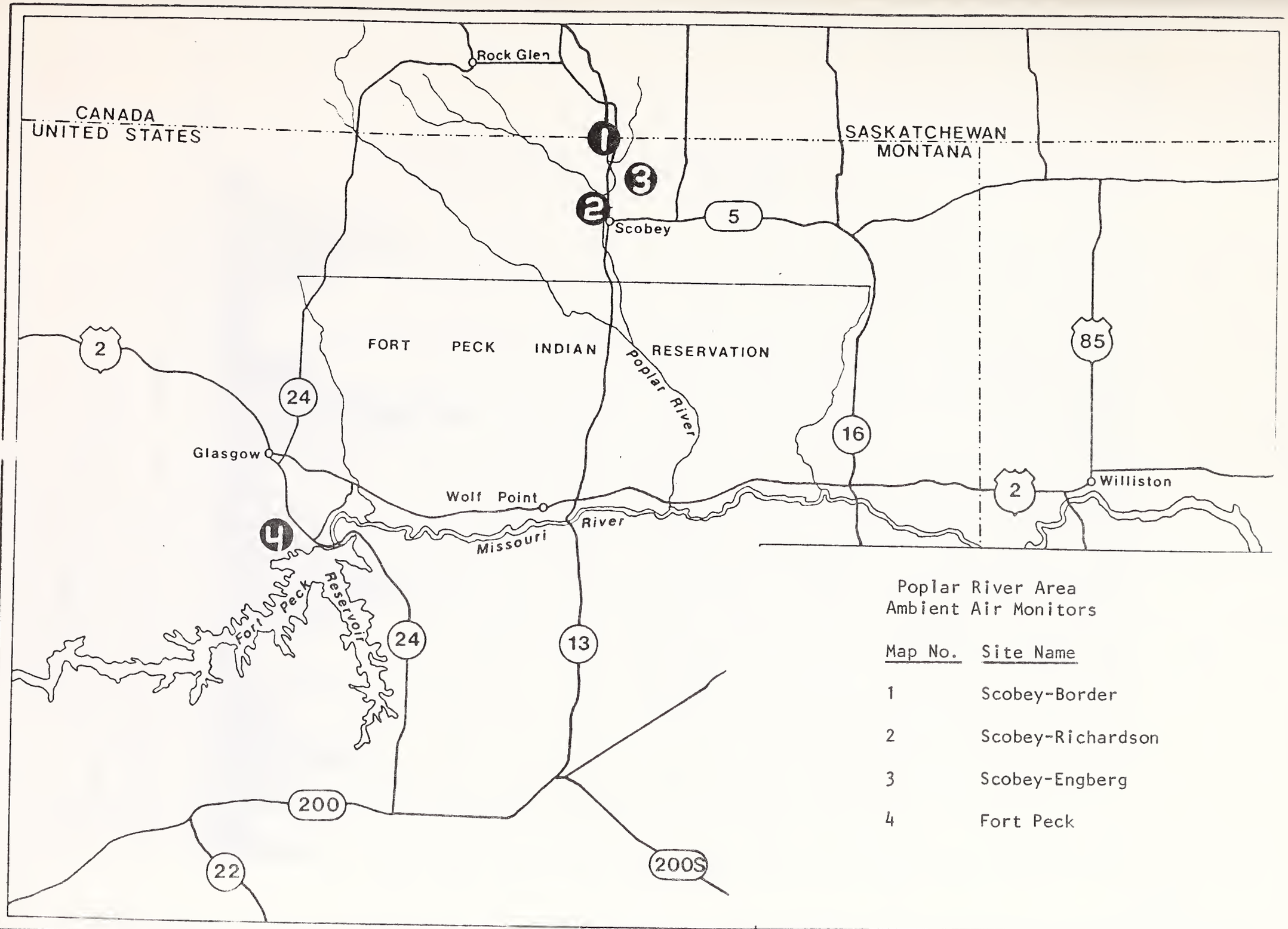
All four sites recorded an annual geometric mean well below the national ambient air quality primary and secondary standard. The pattern at all four sites indicates elevated levels of total suspended particulate during the spring, summer and early fall months, when agricultural field activity is at its peak, and lower levels during the winter months when the ground is not worked and is snow covered.

B. Poplar River Area Wind Summary

Tables VII.B.1 and VII.B.2 summarize the wind speed and direction for the Poplar River area of northeastern Montana for 1978. The data listed is for the Scobey Border Station site some 14 miles north of Scobey at the U.S.-Canadian border. The data was obtained from hourly averages of wind speed and direction. The instrument was located on an eight foot tower located on top of an air quality sampling trailer. The values in the tables are in percent of occurrence for the category listed. The wind speed categories are in meters per second (1 meter per second = 2.2 miles per hour).

Examining the data briefly for 1978, the wind speeds in the Poplar River area averaged monthly from 3.0 to 5.4 meters per second (m/sec). The late summer had the slowest average wind speeds (approximately 3.0 m/sec). The spring season had the highest average wind speeds. The average wind speeds are more than double that of areas west of the continental divide. This increased wind speed of the Poplar River area creates an improved dispersion compared to areas in western Montana.

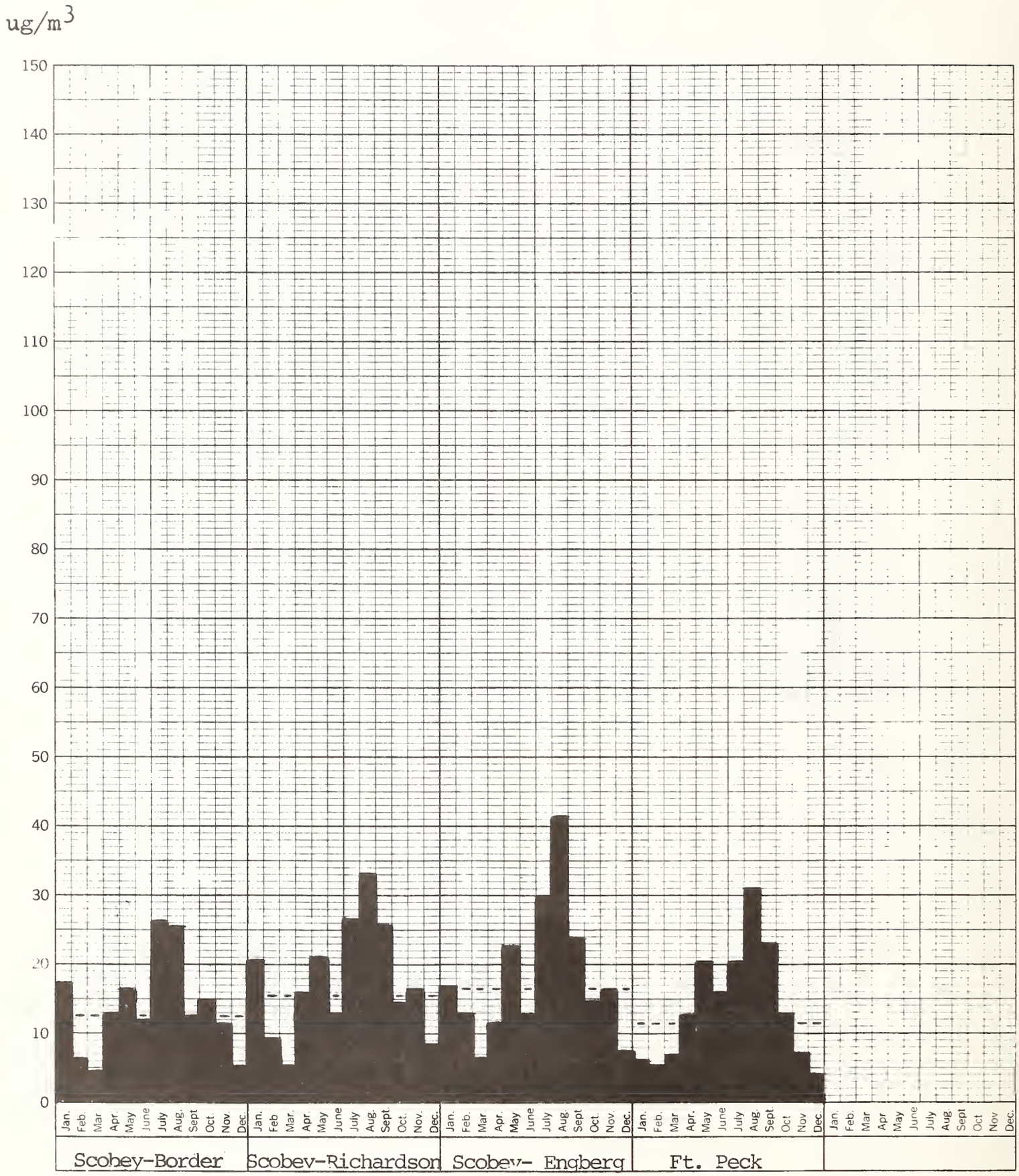
The wind direction data shows a predominance of west to northwest winds during the winter. The remainder of the year did not show a definite pattern. Almost all months had wind directions equally from all directions.



Poplar River Area
Ambient Air Monitors

Map No.	Site Name
1	Scobey-Border
2	Scobey-Richardson
3	Scobey-Engberg
4	Fort Peck

Figure VII.A.2



Location: Poplar River Area

Parameter: Total Suspended Particulate

Units: Micrograms/cubic meter

------: Annual Geometric Mean

TABLE VII.B.1

MONTHLY SUMMARY OF SURFACE WIND SPEED
Scobey - Border Station Site - 1978
(Values in percent of occurrence)

Speed (m/sec)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.*	Sept.	Oct.	Nov.	Dec.
0.1 - 1.5	25.4	22.5	27.9	11.2	15.5	22.0	32.7	32.2	--	30.3	31.5	18.1
1.6 - 3.0	21.3	22.2	19.5	10.8	21.1	21.5	27.6	24.1	--	23.4	20.9	19.1
3.1 - 5.0	25.0	23.7	25.4	31.0	30.4	32.1	22.7	27.2	--	24.1	28.8	19.3
5.1 - 8.0	16.2	14.9	18.1	26.3	23.2	17.5	12.2	11.9	--	20.0	11.4	22.9
8.1 - 10.0	7.5	8.4	6.1	10.6	8.7	5.0	3.2	4.1	--	1.4	2.9	12.5
10.1 - 14.0	4.3	6.3	2.6	8.6	1.1	1.8	1.7	0.6	--	0.7	2.9	7.1
14.1 - 18.0	0.3	2.0	0.3	0.6	0.0	0.2	0.0	0.0	--	0.0	0.6	0.6
18.1 - 22.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	--	0.0	1.1	0.4
Over 22.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	--	0.0	0.0	0.0
Average Speed (m/sec)	3.8	4.4	3.7	5.4	4.2	3.7	3.1	3.0	--	4.4	3.3	4.8

* Less than full month of data

TABLE VII.B.2

MONTHLY SUMMARY OF SURFACE WIND DIRECTION
Scobey - Border Station Site - 1978
(Values in percent of occurrence)

Direction	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug*	Sept.	Oct.*	Nov.	Dec.
N	4.2	6.8	5.4	4.5	11.4	4.0	8.0	2.5	--	1.4	8.1	1.3
NNE	3.9	2.4	2.9	1.8	4.2	2.9	4.2	1.2	--	1.4	3.6	1.8
NE	4.3	6.0	6.4	3.6	3.7	1.1	5.6	2.2	--	0.7	1.5	2.1
ENE	2.8	4.8	2.8	8.2	2.2	1.3	4.1	3.8	--	1.4	0.3	2.8
E	5.0	3.8	1.7	16.0	3.3	5.1	4.9	4.4	--	0.0	2.4	3.0
ESE	2.4	14.6	3.4	14.3	3.9	3.8	3.5	2.8	--	1.4	2.7	3.4
SE	4.4	6.8	7.1	12.2	8.3	7.2	6.2	8.8	--	10.3	7.2	3.7
SSE	5.3	8.1	6.1	3.4	7.8	5.3	6.0	6.2	--	4.8	4.8	4.5
S	8.6	11.1	10.9	3.2	11.1	11.4	6.6	11.2	--	8.3	12.6	8.9
SSW	6.1	5.1	5.6	1.9	5.3	7.2	3.5	5.0	--	10.3	9.2	4.2
SW	3.5	1.4	5.2	2.5	4.4	11.7	4.2	3.4	--	9.0	5.6	7.4
WSW	4.4	1.2	5.0	2.8	4.6	9.3	4.9	4.4	--	8.3	6.0	12.0
W	10.2	2.0	10.3	6.3	5.4	11.4	10.6	9.1	--	9.7	10.2	17.4
WNW	11.1	2.2	8.9	8.2	2.8	6.7	8.1	12.2	--	9.0	7.8	16.6
NW	13.1	11.6	11.4	7.6	9.3	6.3	12.9	16.9	--	21.4	11.4	9.1
NNW	10.9	12.3	6.8	3.8	12.3	5.1	6.8	5.9	--	2.8	6.3	1.7

* Less than full month of data.

VIII EASTERN MONTANA AREA

This section of the report deals with ambient air quality monitoring data collected in the southeastern area of Montana. Data concerning total suspended particulate will be discussed. Most of the data is represented in the forms of graphs. No meteorological data is available.

The southeastern section of the state is essentially rolling plains with some smaller mountains and buttes. The climate is harsh with long, cold winters and hot dry summers. The basic industry of the area is agriculture. There is some timber and coal development in the area. The population of the region is sparse. Air monitoring was performed to obtain background information in areas of possible future coal development or in areas of existing coal strip mines and power plants.

1. Total Suspended Particulate

Total suspended particulate was monitored at several locations in the eastern Montana area in 1978. Five sites were selected to be discussed here as representative of the region. The Decker site is located near the Decker Coal Company strip mine, about five miles northeast of the town of Decker. The town of Decker is approximately 15 miles north of Sheridan, Wyoming. This site, which was in operation for 7 months during 1978 recorded a geometric mean for that period of 56.3 ug/m^3. The highest monthly average was 88 ug/m^3 for April.

The Colstrip site is about 2½ miles southeast of the Montana Power Company's coal-fired electrical power generating plants and near a large coal strip mine. The monitoring site was in operation for 6 months of 1978.

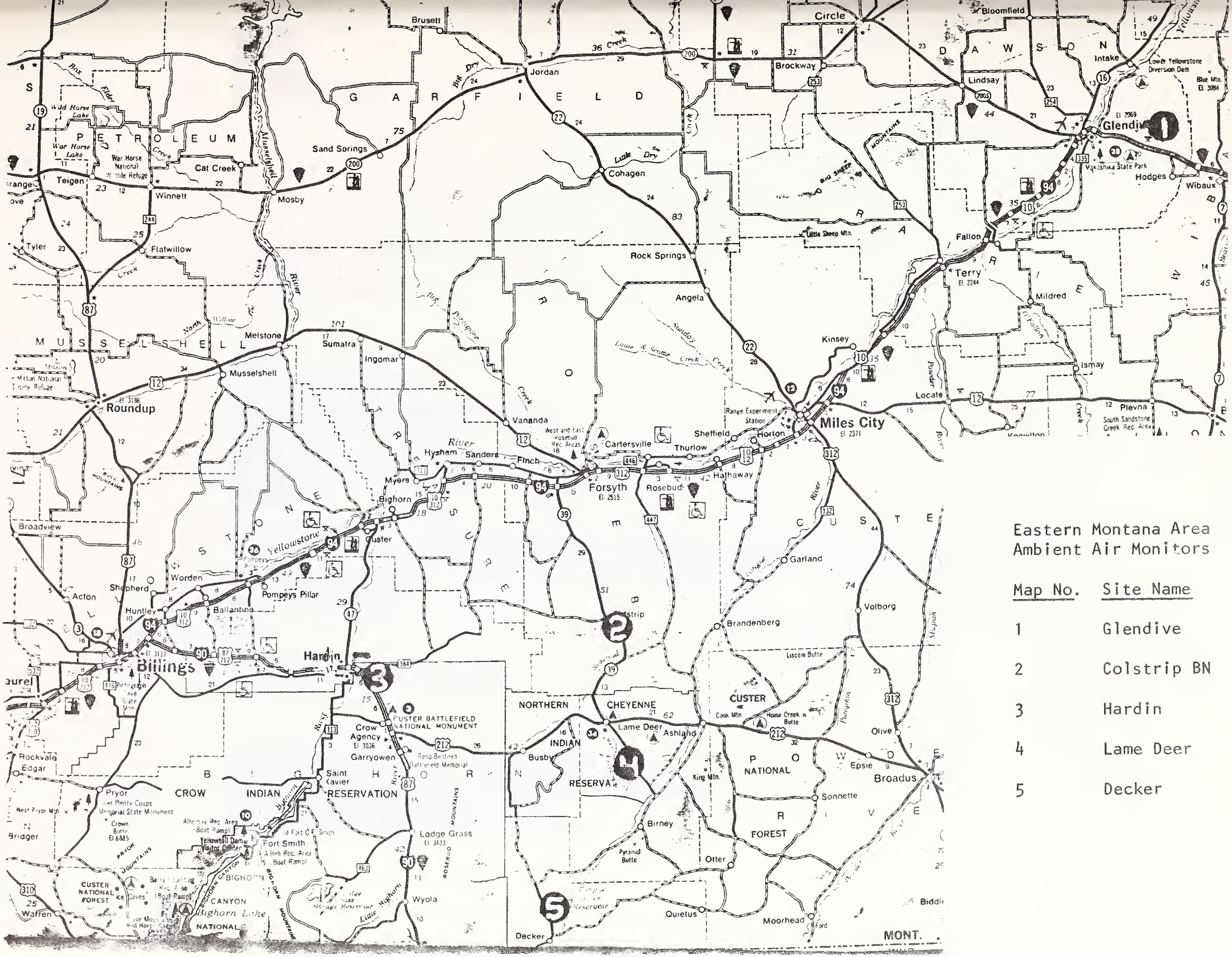
The geometric mean for that period was 16.6 ug/m^3. The highest monthly average was 138 ug/m^3 for the month of October.

The Hardin site is located on the Crow Indian Reservation near the town of Hardin. Hardin is approximately 50 miles east of Billings. The site recorded an annual geometric mean of 19.5 ug/m^3. The highest monthly average was 56 ug/m^3 for the month of August. This location seemed to show a pattern of elevated readings during the spring, summer and fall months and lower readings during the winter.

The Glendive site is approximately 10 miles east of the town of Glendive. The site was in operation from May through August of 1978. The geometric mean for that period was 22.6 ug/m^3. The highest monthly average was 35 ug/m^3 for August.

The Lame Deer site is 10 miles southeast of the town of Lame Deer on the Northern Cheyenne Indian Reservation. The site was in operation for eight months during 1978. The geometric mean for that period was 8.9 ug/m^3. The highest monthly average, 26 ug/m^3, was recorded for August.

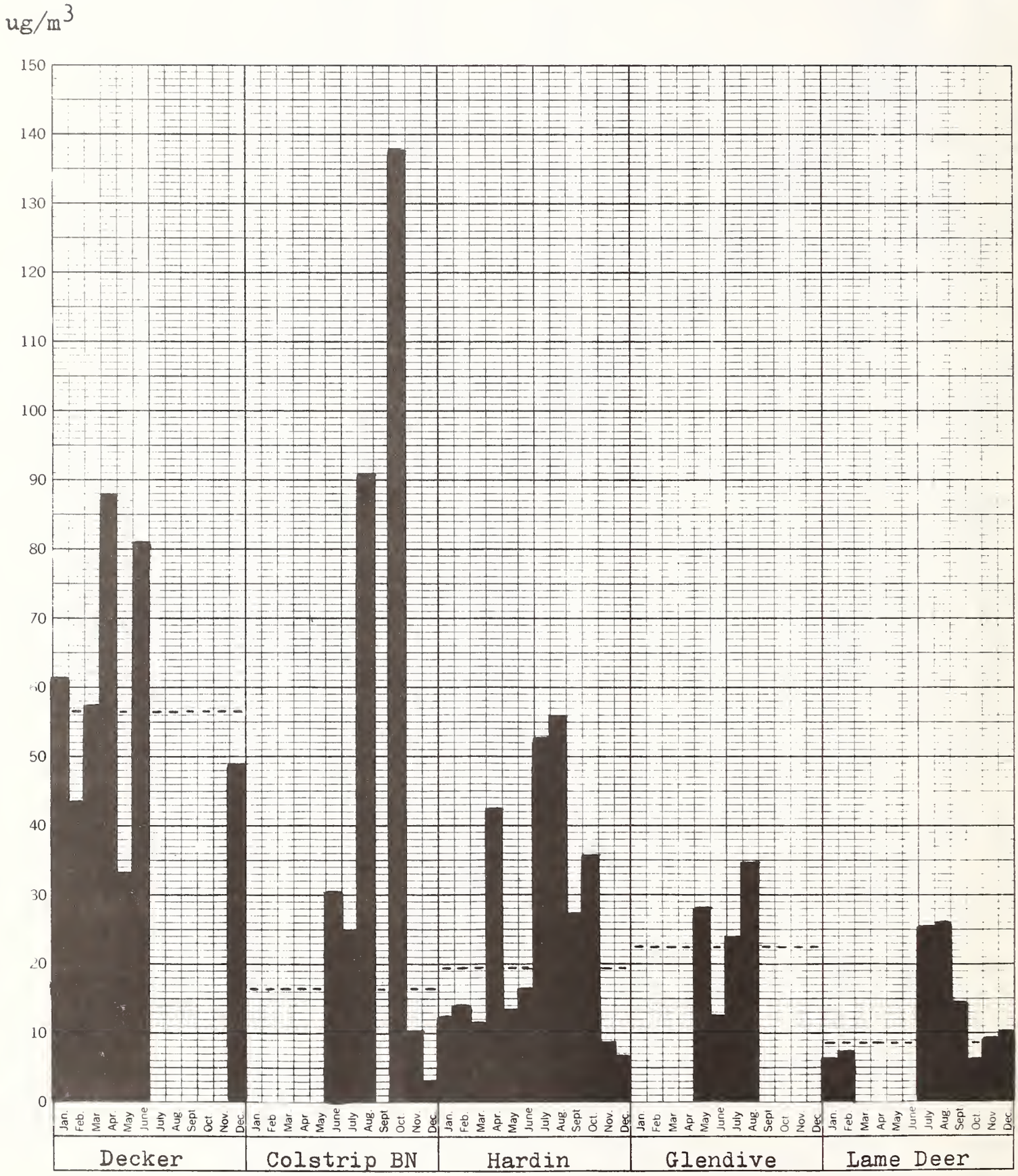
All five sites recorded a geometric mean below the national ambient air quality secondary standard of 60 ug/m^3. The Hardin site was the only site, however, where a precise annual geometric mean could be calculated.



Eastern Montana Area
Ambient Air Monitors

Map No.	Site Name
1	Glendive
2	Colstrip BN
3	Hardin
4	Lame Deer
5	Decker

Figure VIII.A.2



Location: Eastern Montana

Parameter: Total Suspended Particulate

Units: Micrograms/cubic meter

------: Annual Geometric Mean

IX. HELENA AREA

A. This section of the report concerns itself with ambient air quality data collected at Helena, East Helena and Bozeman locations. Data concerning total suspended particulate, sulfur dioxide, and various meterological parameters are discussed. Most of the information is represented in the form of graphs and figures.

Helena and East Helena are located about four miles apart at approximately 4,000 feet elevation at the south end of the Helena Valley. The valley generally experiences low wind speed and calm conditions with frequent temperature inversions which tend to trap and concentrate pollutants. The population of Helena was 22,730 in 1970 and is estimated to be 30,200 by 1985. East Helena had a population of 1657 in 1970 and is estimated to be 2250 in 1985.

The major industrial source of air pollution emissions in the Helena Valley is the ASARCO lead smelter located in East Helena. The smelter is a source of sulfur dioxide, particulates and carbon monoxide. Automotive and home heating emissions may also be sources of pollutants.

Bozeman is located at the east edge of the Gallatin Valley at the junction of the Bridger and Gallatin Mountain Ranges. The town lies about 50 miles north of Yellowstone National Park. The elevation of Bozeman is approximately 4800 feet. Bozeman had a 1970 population of 18,670 and is estimated to have 23,150 residents by 1985. Bozeman is predominantly a University and tourist community set in an agricultural valley. There are

no major sources of pollution in the area outside of automobiles, home heating devices and some light industry in the area.

1. Total Suspended Particulate

Total suspended particulate was monitored at four sites in the Helena-East Helena area and at one site in Bozeman during 1978. The Helena sites, Cogswell #1 and #2, are situated on the roof of the Cogswell Building near the Montana State Capitol Building in the southeast section of town. The 212 Pacific site is located in the town of East Helena. The Microwave site is located on a hill approximately 2 miles south of the ASARCO smelter. The Bozeman site is located on the University of Montana campus.

The highest annual geometric mean, 77.6 ug/m^3, was recorded at the 212 Pacific site in East Helena. This was in violation of the national ambient air quality primary annual geometric mean standard of 75 ug/m^3. All other sites in the area were below the national secondary standard 60 ug/m^3. The lowest annual geometric mean, 23.4 ug.m^3, was recorded at the Microwave site.

2. Sulfur Dioxide

Sulfur dioxide was monitored at three sites in the East Helena area during 1978. These locations include the Broudy Ranch site about four miles southeast of East Helena; the East stack site about 1.3 miles east of the ASARCO smelter; and the Microwave site described above.

All three sites recorded annual averages below the state and national ambient air quality annual average standards of .02 ppm and .03 ppm respectively. All three sites, however, recorded numerous violations of the state 1-hour standard of .25 ppm.

The sulfur dioxide levels at all three sites were highest in January and February and lowest in December. The highest monthly average was .028 for January at the Broudy Ranch site. The maximum 1-hour reading, .80 ppm,

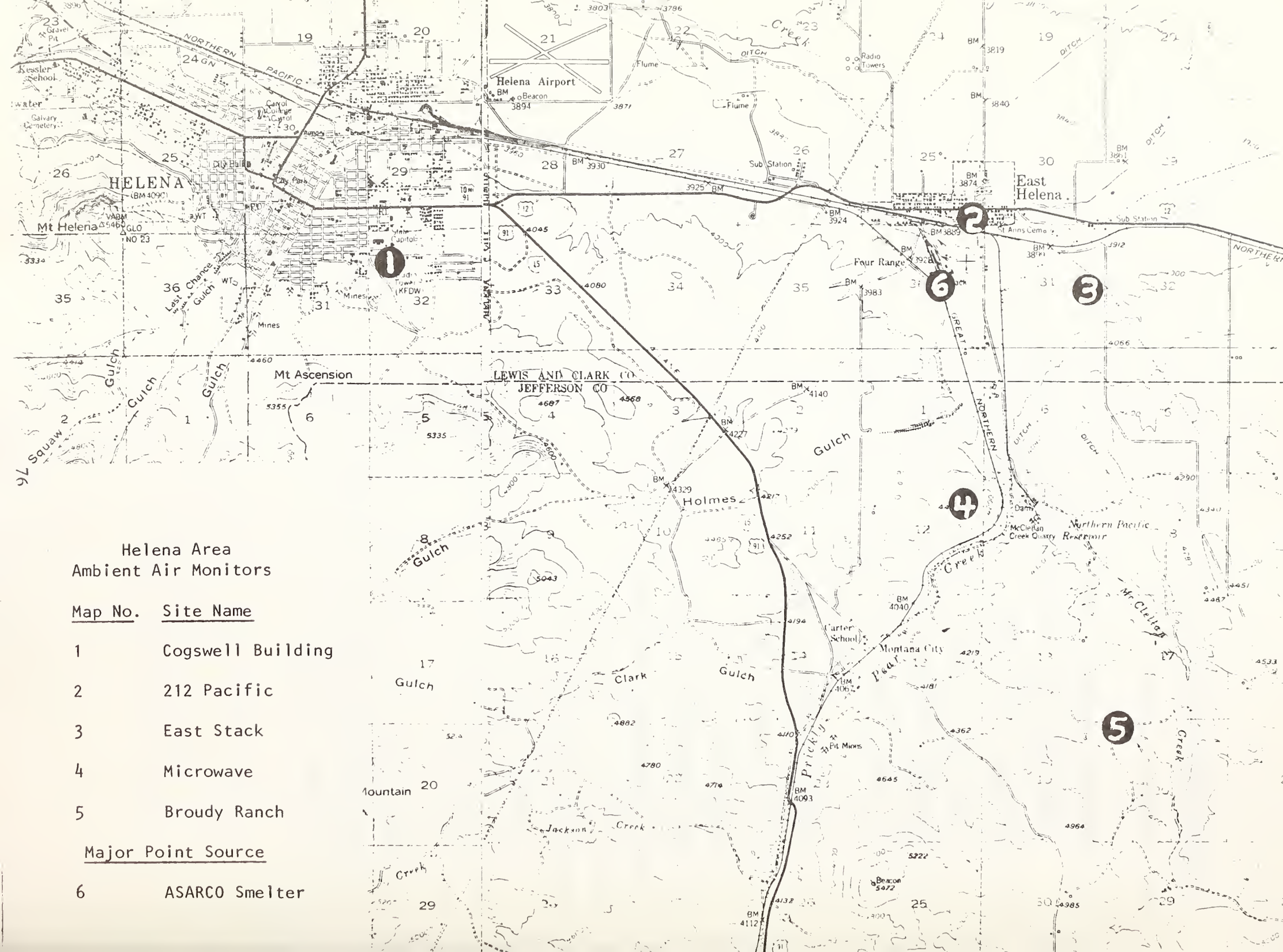
was also recorded at the Broudy Ranch site in January. Sulfur dioxide was not monitored in Bozeman in 1978.

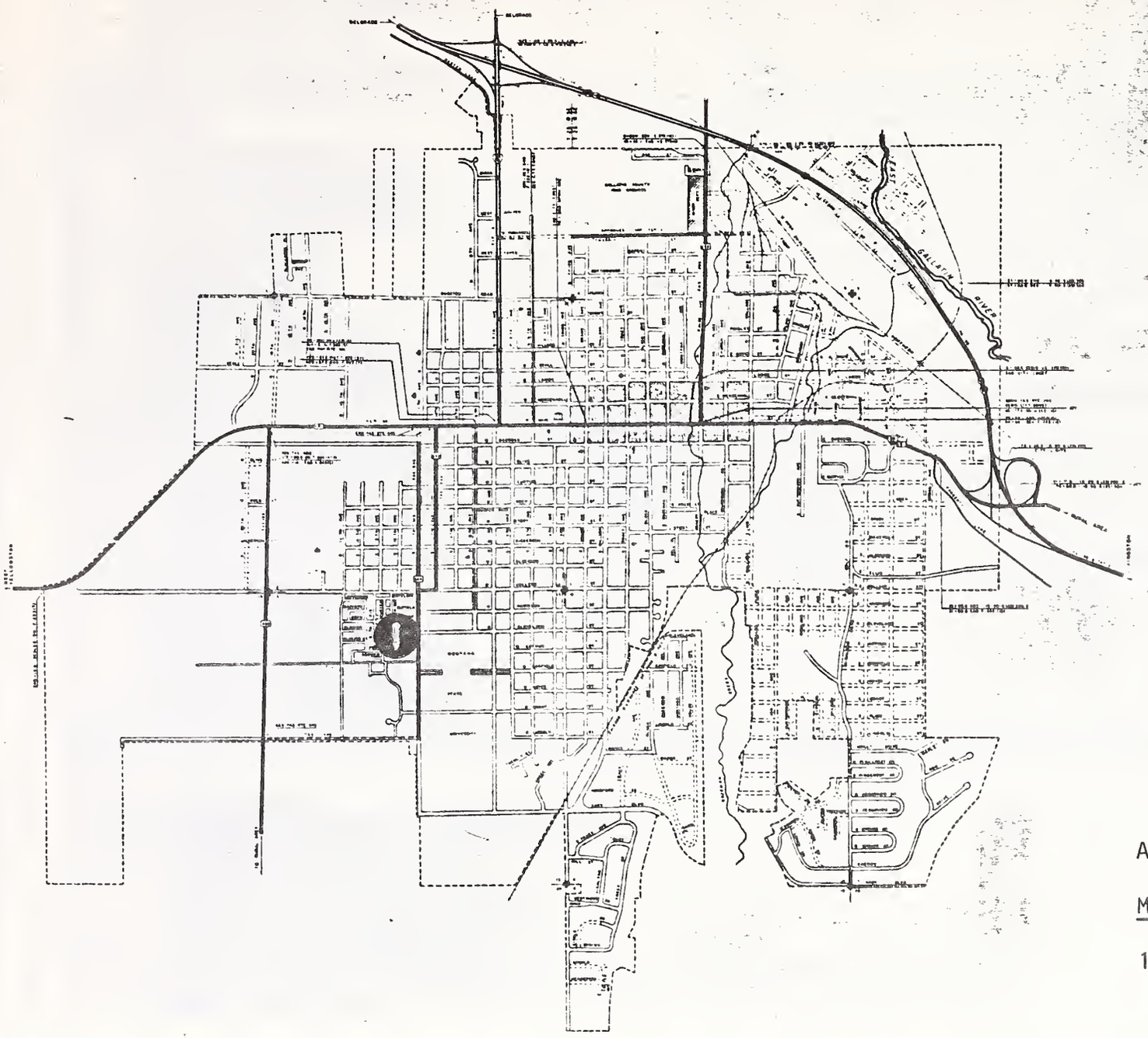
B. East Helena Area Wind Summary

Tables IX.B.1 and IX.B.2 summarize the wind speed and direction for the East Helena area for 1978. The data lsited is for the Microwave site some three miles south of East Helena. The data was obtained from hourly averages of wind speed and direction. The instrument was located on a 30 foot tower next to an air quality sampling ttailer. The values in the tables are in percent of occurrence for the category listed. The wind speed categories are in meters per second (m/sec).

The wind speed data (Table IX.B.1) shows a monthly average wind speed ranging from 2.8 to 5.9 m/sec. The highest average speeds occurred during the late spring with May having the highest average speed. The lowest average speed occurred during the late winter with February having the lowest speed. During May only 4.3 percent of the winds were less than1.6 m/sec while during February this figure was 45.0 percent.

The wind direction data demonstrated a predominance of westerly winds. The most frequent wind occurred from south-southwest through north-northwest. This predominance occurred pretty much year round. However, during the summer and fall seasons, the south-southwest wind direction had a much higher frequency of occurrence than other times during the year. The least frequent wind directions were from the east-northeast through south.

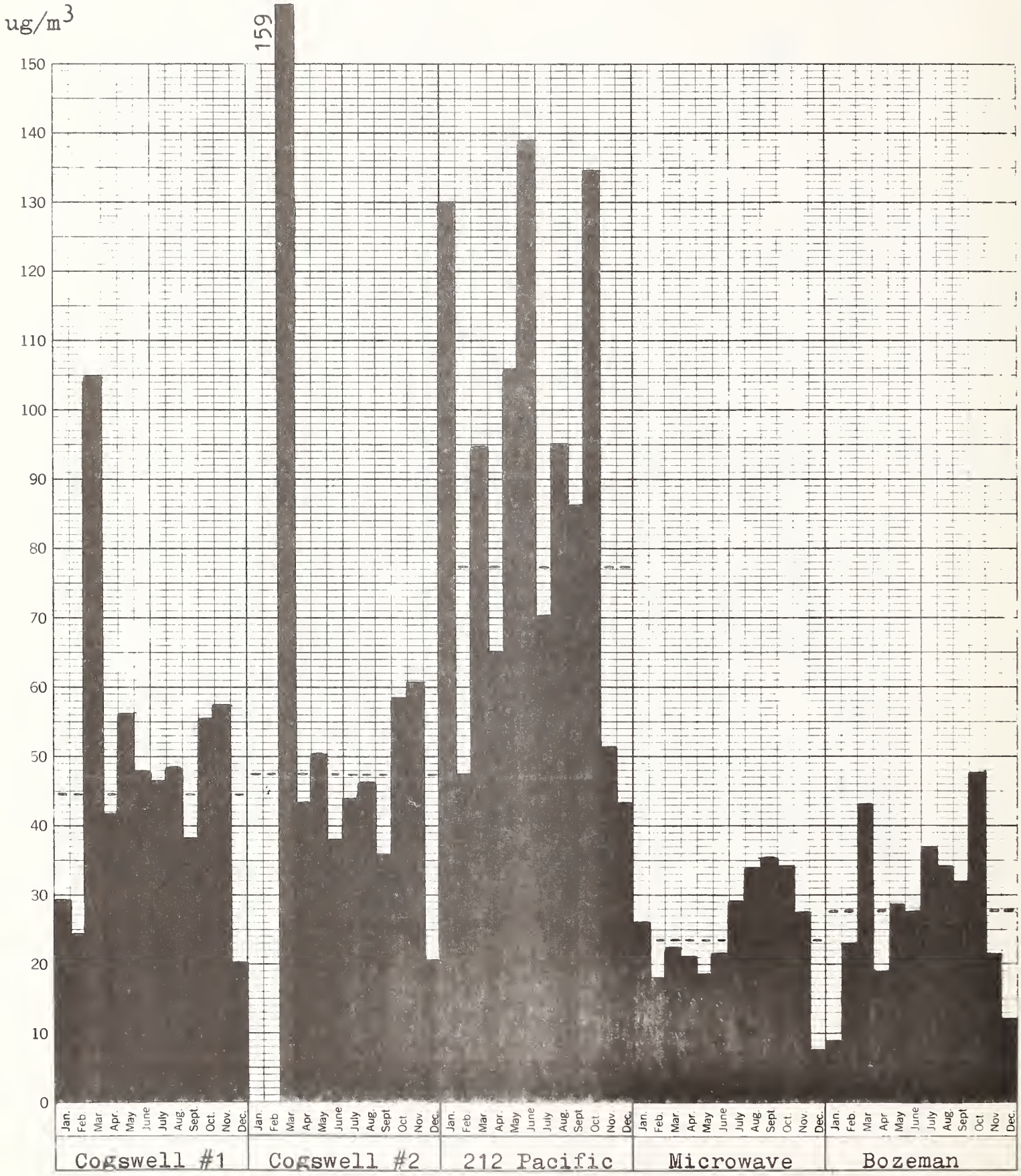

Helena Area
Ambient Air Monitors
Map No. Site Name
1 Cogswell Building
2 212 Pacific
3 East Stack
4 Microwave
5 Broudy Ranch
Major Point Source
6 ASARCO Smelter
HELENA
Helena Airport
East Helena
Mt Helena
Mt Ascension
LEWIS AND CLARK CO
JEFFERSON CO
Holmes
Four Range
Montana City
Northern Pacific
NORTHERN PACIFIC
GREAT NORTHERN
Last Chance Gulch
Squaw Gulch
Clark Gulch
Prickly Pear Creek
McClellan Creek
Jackson Creek
Carter School
McClellan Creek Quarry
Pit Mines
Sub Station
Radio Towers
Flume
DITCH
Mines
Gravel Pit
Kessler School
Calvary Cemetery
City Hall
City Park
State Capitol
St Anns Cemetery
Beacon
Dam
Reservoir
Mountain



Bozeman Area
Ambient Air Monitors

Map No.	Site Name
1	Bozeman Site

Figure IX.A.2



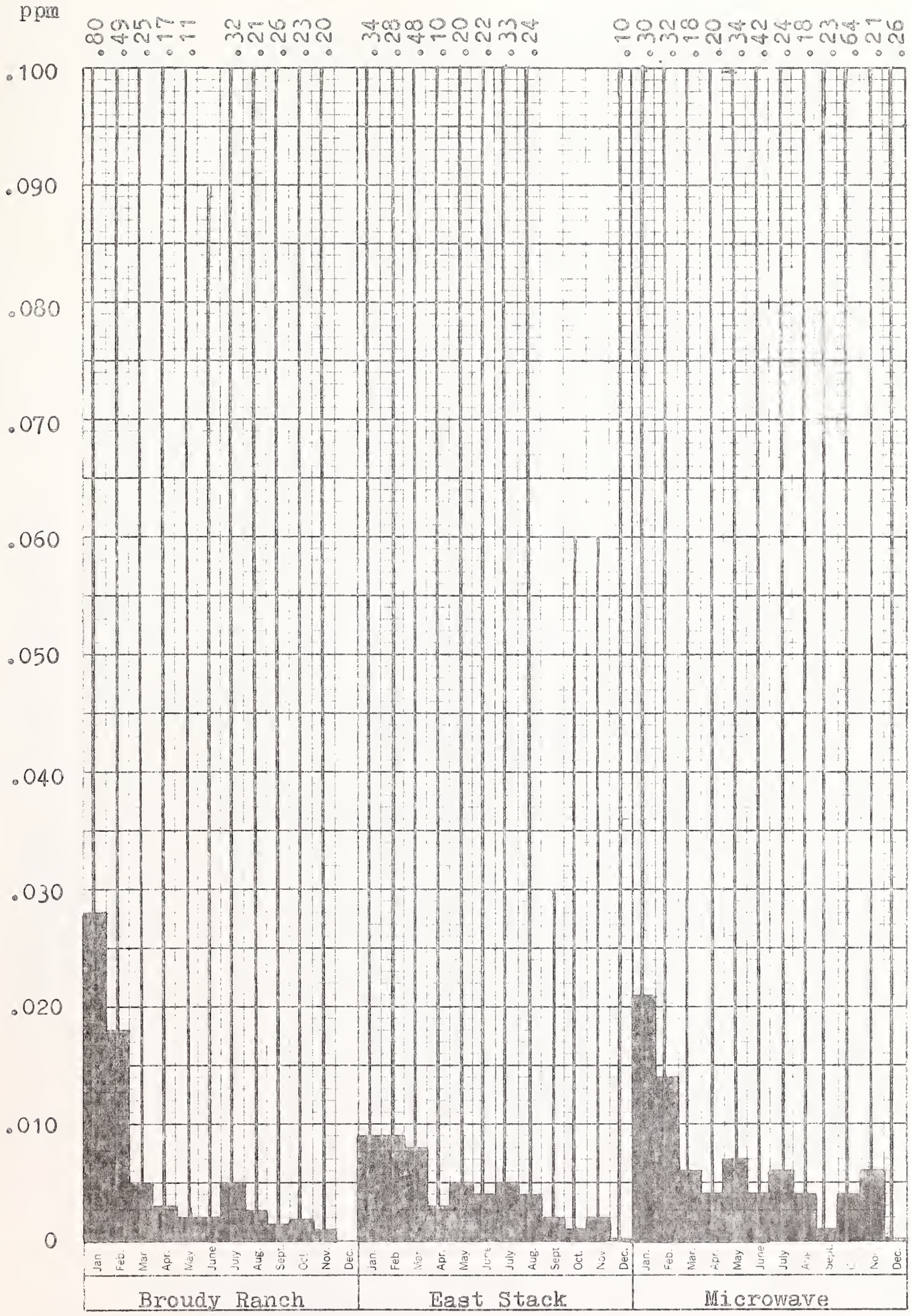
Location: Helena Area

Parameter: Total Suspended Particulate

Units: Micrograms/cubic meter

------: Annual Geometric Mean

Figure IX.A.3



Location: Helena Area

Center Line: High Hour Reading

Parameter: Sulfur Dioxide

Units: Parts per million

TABLE IX.B.1

MONTHLY SUMMARY OF SURFACE WIND SPEED
East Helena - Microwave Site - 1978
(Values in percent of occurrence)

Speed (m/sec)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0.1 - 1.5	46.8	45.0	23.9	8.0	4.3	5.0	6.8	6.3	12.9	12.6	23.5	17.3
1.6 - 3.0	11.6	23.7	19.3	22.4	12.7	18.4	23.0	17.6	22.4	22.3	18.6	17.9
3.1 - 5.0	17.3	11.3	24.2	29.9	24.1	31.6	30.6	32.5	23.9	24.8	21.7	15.8
5.1 - 8.0	18.8	15.3	25.6	24.8	35.7	32.9	28.8	34.7	30.6	26.0	19.9	24.0
8.1 - 10.0	4.6	4.6	6.3	7.8	16.8	9.2	9.0	7.2	7.6	10.9	10.1	14.4
10.1 - 14.0	0.9	0.0	0.7	4.1	6.4	2.4	1.8	1.5	2.4	2.5	4.3	9.2
14.1 - 18.0	0.0	0.0	0.0	2.2	0.0	0.4	0.0	0.1	0.1	0.0	1.4	1.5
18.1 - 22.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Over 22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Speed (m/sec)	3.0	2.8	4.0	5.0	5.9	5.1	4.8	4.9	4.6	4.7	4.6	5.5

TABLE IX.B.2

MONTHLY SUMMARY OF SURFACE WIND DIRECTION
East Helena - Microwave Site - 1978
(Values in percent of occurrence)

Direction	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
N	4.9	2.3	3.9	4.4	4.8	7.8	4.4	7.1	5.0	4.6	1.1	0.2
NNE	3.0	1.9	2.5	2.9	1.4	6.2	11.3	11.2	3.0	4.5	2.4	0.3
NE	1.6	1.5	1.8	2.4	1.0	2.3	2.3	2.2	2.9	1.1	0.6	0.3
ENE	1.0	1.5	2.5	1.5	1.4	3.2	3.3	2.2	3.6	3.4	0.8	0.0
E	0.7	1.5	1.1	0.7	0.2	1.9	1.1	0.6	0.9	1.9	1.0	0.4
ESE	1.9	2.9	3.8	2.4	0.4	3.5	3.3	1.5	2.2	1.9	2.7	2.5
SE	1.2	1.9	0.8	1.2	0.9	1.3	1.2	0.4	1.2	1.2	1.4	1.6
SSE	2.7	2.9	2.5	2.2	0.7	2.0	1.6	0.8	3.3	1.8	1.8	4.5
S	2.2	1.7	1.7	2.2	1.4	1.0	1.5	1.1	2.7	1.6	3.5	2.7
SSW	12.9	12.8	19.9	15.1	18.9	28.8	32.0	33.7	34.0	40.4	32.8	21.3
SW	6.3	4.2	7.7	4.4	7.3	6.3	4.5	4.6	6.3	4.6	5.6	6.6
WSW	15.2	9.0	15.2	11.2	13.0	8.4	5.2	9.6	12.4	9.4	11.6	25.1
W	7.3	7.4	6.4	9.5	7.8	4.6	1.2	3.8	3.2	5.7	6.1	8.0
WNW	16.8	23.7	15.8	19.7	13.0	11.1	9.8	9.2	9.0	8.3	15.1	15.2
NW	10.5	13.2	6.6	9.2	9.7	4.0	5.7	5.9	3.7	4.1	5.0	6.8
NNW	12.0	11.6	7.7	11.0	18.2	7.6	11.5	6.2	6.6	5.2	8.4	4.5

X. GREAT FALLS AREA

Section X of this report concerns itself with ambient air monitoring in the Great Falls area. All data was gathered within the city. Data concerning total suspended particulate and carbon monoxide are discussed. Most of the data is represented in the form of graphs and figures. No meteorological data is available.

The elevation of Great Falls is approximately 3,300 feet. The city rests at the confluence of the Sun and Missouri Rivers. The area around Great Falls is a borderline area between the Rocky Mountains to the west, and the Great Plains to the east. The climate tends to be cold and windy in the winter and hot and windy in the summer. The 1970 population of Great Falls was 60,091 and is estimated to be 65,100 by 1985.

Sources of air pollution in the Great Falls area include two grain mills and an oil refinery. Automobiles and home heating devices must also be considered as possible sources along with some other light industry in the area.

1. Total Suspended Particulate

Total suspended particulate was monitored at 3 locations in Great Falls during 1978. All three sites recorded an annual geometric mean below the national ambient air quality secondary standard of 60 ug/m^3.

The Hospital site, located on the south side of the city, was in operation throughout 1978. The annual geometric mean at the site was 42.4 $ug.m^3$ with the highest monthly average, 137 ug/m^3, recorded for September. The lowest monthly average, 18.5 ug/m^3, was for January.

The Fire Station site at 1st Avenue South and 9th Street South, also operated throughout the year. This site showed the highest annual geometric mean of the three sites at 56.3 ug/m^3. The highest monthly average, 107 ug/m^3 was recorded in March. The lowest monthly average, 18.5 ug/m^3, was in January.

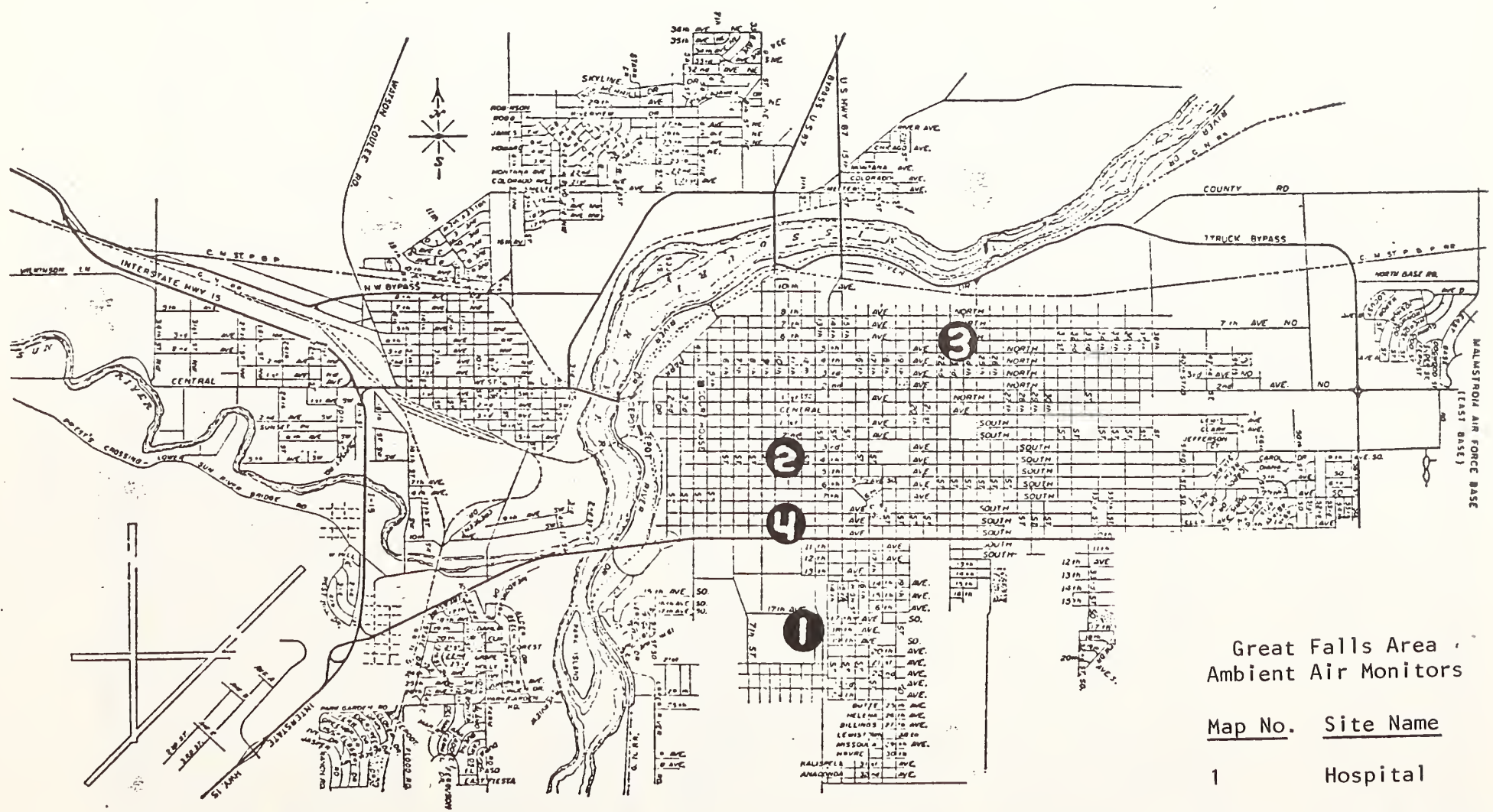
A new site, monitoring total suspended particulate, was erected at North Kiwanis Park in November 1978. Insufficient data was obtained to determine an annual geometric mean. The month of November showed an average concentration of 21 ug/m^3 and December recorded an average of 18 ug/m^3.

The Hospital and Fire Station sites showed elevated total suspended particulate levels during the late spring and early fall months with January recording the lowest levels in both cases. It is impossible to determine any pattern using the available data from North Kiwanis Park.

2. Carbon Monoxide

Carbon monoxide, a pollutant generated by internal combustion engines, was monitored at a site near 10th Ave. South and 9th Street South in Great Falls in 1978. The highest monthly average recorded was 3.8 ppm for February. The highest 1-hour maximum reading was 24 ppm also recorded in February. The lowest monthly average, 1.85 ppm, was recorded in April. All readings were below the national ambient air quality 1-hour primary standard of 35 ppm.

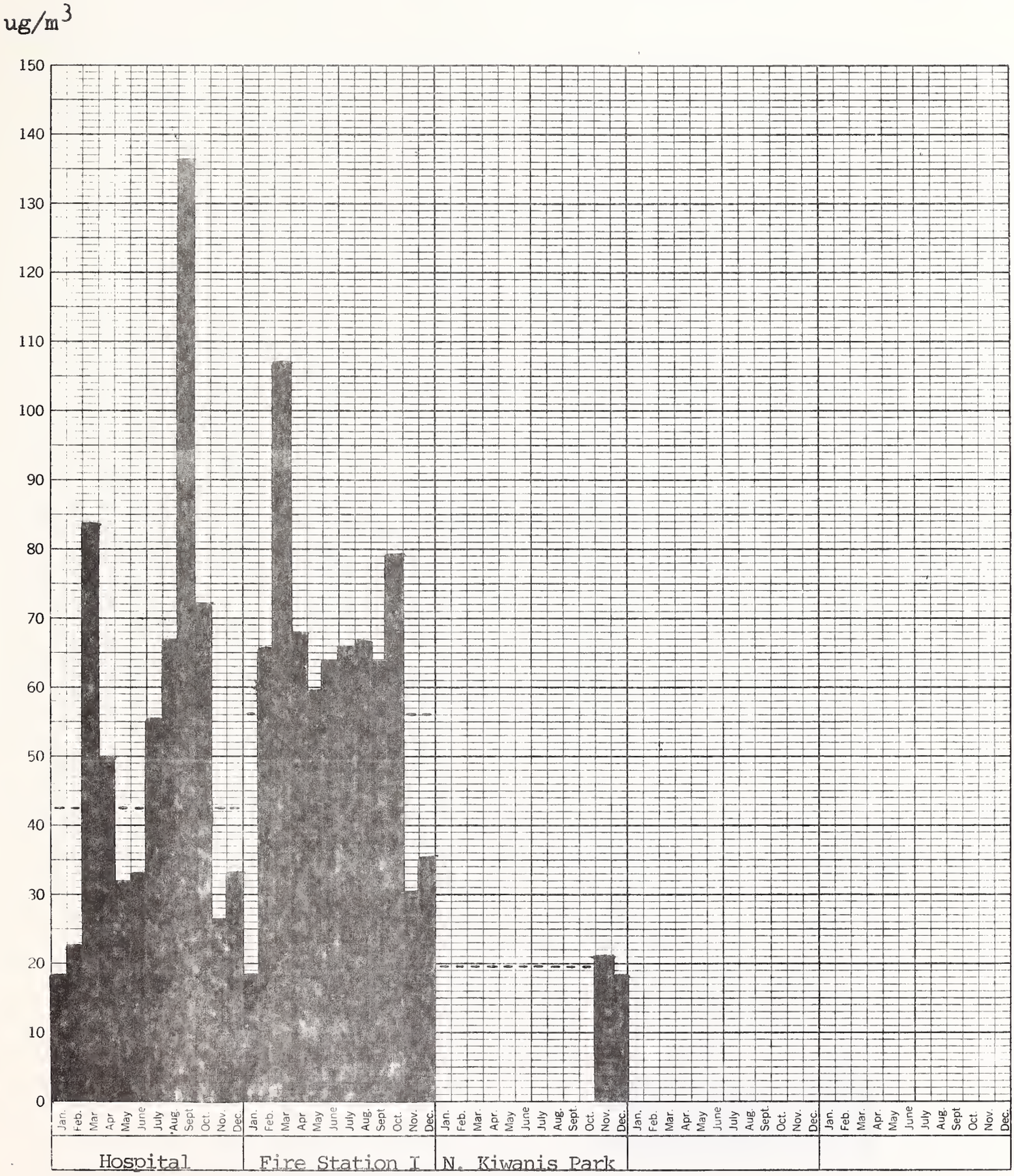
There were, however, several violations of the national 8-hour average standard of 9 ppm. The State of Montana does not have a carbon monoxide standard at this time. The general pattern seems to indicate elevated levels of carbon monoxide during the fall, winter and early spring, with lower concentrations in the late spring and summer months.



Great Falls Area
Ambient Air Monitors

Map No.	Site Name
1	Hospital
2	Fire Station #1
3	North Kiwanis Park
4	10th Ave. So.

Figure X.A.2



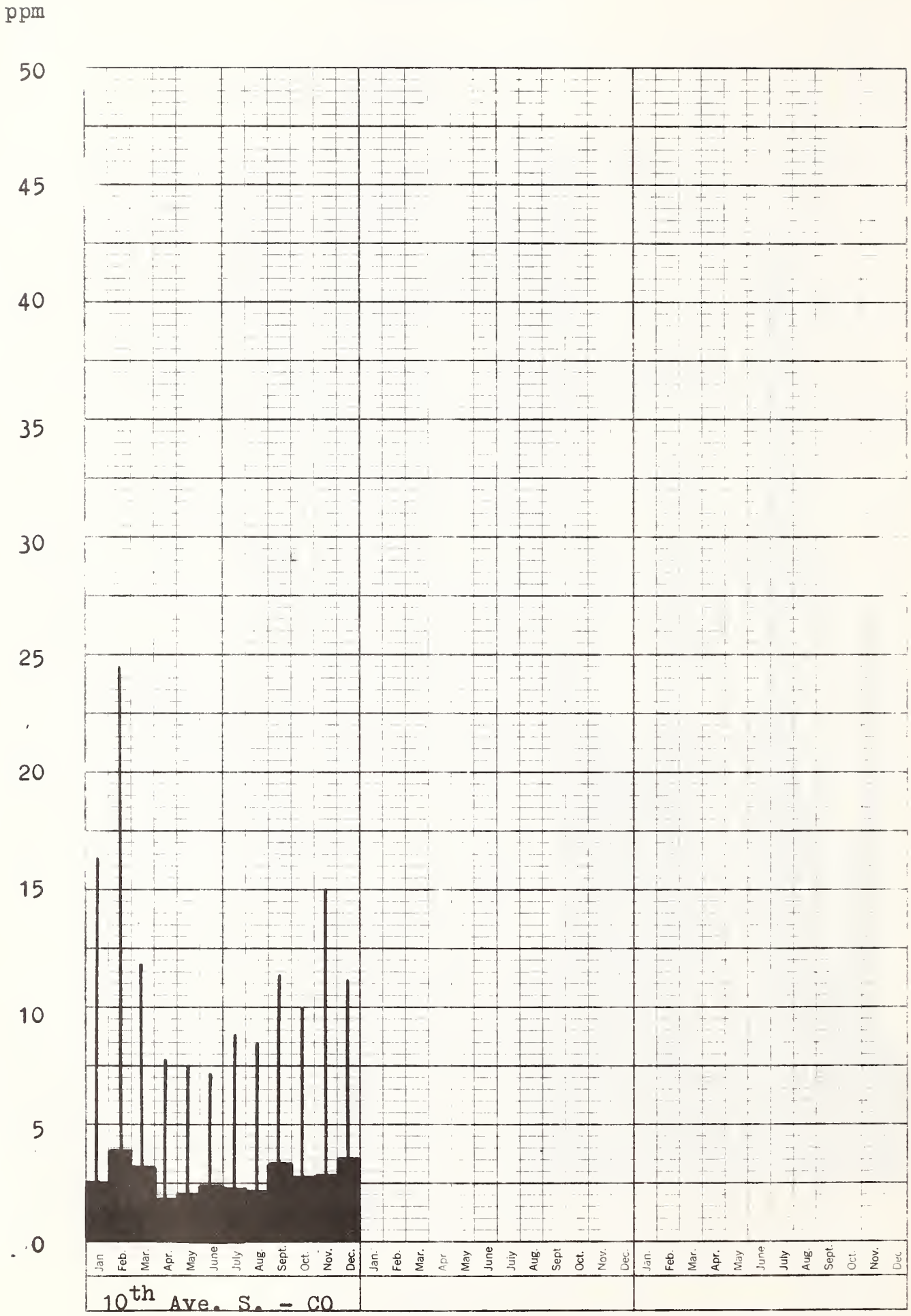
Location: Great Falls Area

Parameter: Total Suspended Particulate

Units: Micrograms/cubic meter

------: Annual Geometric Mean

Figure X.A.3



Location: Great Falls Area

Center Line: High Hour Reading

Parameter: Carbon Monoxide

Units: Parts per million

APPENDIX A

Montana Ambient Air Quality Standard

Pollutant	Standard	Averaging Time
Suspended Particulates	75 ug/m^3	Annual
	200* ug/m^3	24-Hour
Sulfur Dioxide	0.02 ppm	Annual
	0.10+ ppm	24-Hour
	0.25[a] ppm	1-Hour
Settled Particulates	15 T/mi^2 (residential area)	3-Month
	30 T/mi^2 (industrial area)	3-Month
Suspended Sulfates	4 ug/m^3	Annual
	12[b] ug/m^3	--
Reactive Sulfur	0.25 mg SO_3/ 100 cm^2/day	Annual
	0.50 mg SO_3/ 100 cm^2/day	1-Month
Fluorides, Total in air (as HG)	1 ppb	24-Hour
Fluorides (Gaseous)	0.3 ug/cm^2/28 days	28-Days

[a]Not to be exceeded for more than one hour in any four consecutive days.

[b]Not to be exceeded more than one percent of the time.

*Not to be exceeded more than one percent of the days in a year.

+Not to be exceeded more than one percent of the days in a 3-month period.

Federal Ambient Air Quality Standards

Pollutant	Primary (ug/m^3)	Primary (ppm)	Secondary (ug/m^3)	Secondary (ppm)	Averaging Time
Particulates	75	---	60	---	Annual
	260*	---	150*	---	24-Hour
Sulfur Dioxide	80	0.03	---	---	Annual
	365*	0.14	---	---	24-Hour
	---	---	1,300*	0.5	3-Hour
Carbon Monoxide	10,000*	9.0	---	---	8-Hour
	40,000*	35.0	---	---	1-Hour
Photochemical Oxidants	160*	0.08	---	---	1-Hour
Hydrocarbons	160*	0.24	---	---	3-Hour (6-9 a.m.)
Nitrogen Oxides	100	0.05	---	---	Annual
Lead	1.50	---	---	---	Quarter

* Not to be exceeded more than once/year.

FEDERAL PREVENTION OF SIGNIFICANT DETERIORATION

ALLOWABLE INCREMENTS

	Area Classification				
	I	II	II-Mod.*	III	Not to Exceed
Particulates					
Annual Geo. Mean	5	19	19	37	75
Maximum 24-hour	10	37	37	75	150
Sulfur Dioxide					
Annual Arith. Mean	2	20	20	40	80
Maximum 24-hour	5	91	91	182	365
Maximum 3-hour	25	512	325	700	1300

*Applies to plants near Class I areas

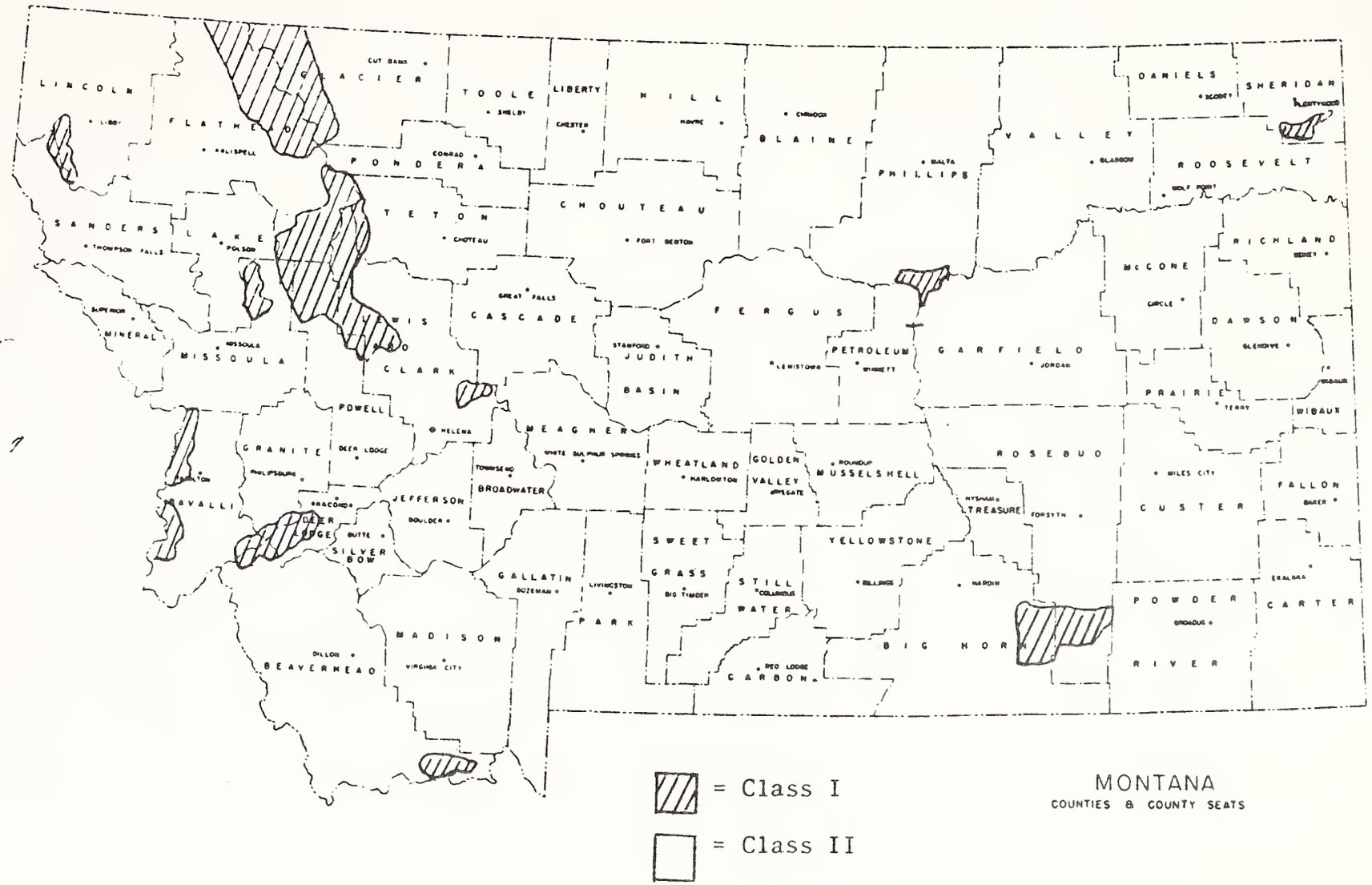
FEDERAL CLASS I AREAS

1978

Area	Location
Glacier National Park	NE Kalispell
Yellowstone National Park	S Bozeman
Bob Marshall Wilderness Area	SE Kalispell
Anaconda-Pintlar Wilderness Area	SW Anaconda
Selway-Bitterroot Wilderness Area	W Hamilton
Cabinet Mountains Wilderness Area	W Libby
Scapegoat Wilderness Area	NW Helena
Gates of the Mountains Wilderness Area	NE Helena
Mission Mountains Wilderness Area	SE Polson
Red Rock Lakes National Wildlife Refuge	S Virginia City
Medicine Lake National Wildlife Refuge	S Plentywood
U. L. Bend National Wildlife Refuge	SW Glasgow
Northern Cheyenne Reservation	SE Hardin

FEDERAL PREVENTION OF SIGNIFICANT DETERIORATION AREAS

1978



APPENDIX B

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